FACTORY

MANAGEMENT AND MAINTENANCE

IN TWO PARTS – PART ONE

SEPTEMBER 1945

Reconversion Communiqué · Royalties for Unions
Atomic Energy · Reconversion Guide

This plant COMES UP with a proven answer to a common maintenance problem

BYERS WROUGHT IRON

Every power plant has a stack problem, and it's always interesting —and frequently helpful—to see what the other fellow does about it. A good example of sound and wide-spread practice is given by this power-house stack 6'6" in diameter and 100 ft. high, illustrated here during erection at the plant of Dairy Distributors, Inc., of Watertown, Wis. Intent on getting maximum life, the engineers used Byers Wrought Iron, which has an impressive record in stack service.

The varying degree of corrosion encountered makes it impossible to say with assurance how long any individual stack will last. But in any application where an unlined metal stack can be properly used, correct design and correct materials can definitely make it last *longer*. And the weight of the evidence indicates that the "correct" material is generally wrought iron.

This letter from a user reports a typical experience. He wrote, ". . . received the parts of two smokestacks from you in 1936. These plates were installed on the upper half of two of our stacks at that time. They have been in service continuously and apparently are in good enough condition to last several years longer. During the time that these stacks have been in service, we installed stacks manufactured from common sheets which have had to be replaced, replacement being due either to condition of the gases or temperature or both."

The acids formed when carbon and sulfur compounds are absorbed by moisture will attack any commercial metal used for stacks. It is wrought iron's unusual defense, which is due to its unusual structure, that gives it durability. Tiny fibers of glass-like silicate slag, threaded through the main body of high-purity iron, halt and deflect corrosive attack, and so discourage pitting. Further, these fibers help anchor the initial protective film, which shields the underlying metal.

A review of the corrosion problems ordinarily encountered in stacks, and details of a number of wrought iron installations, are given in our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment." We will gladly send you a copy on request.

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CORROSION COSTS YOU MORE THAN WROUGHT IRON

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FACTORY

MANAGEMENT AND MAINTENANCE

September, 1945

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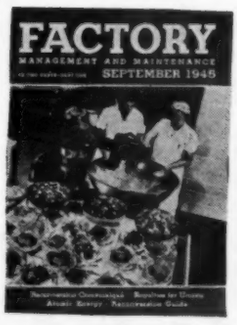

COVER PICTURE

There are vitamins in those salads. Nutritious food at reasonable cost has been a "must" for war workers, will continue to be a must in peacetime operation. Boeing Airplane Company Kodachrome.

Factory Management and Maintenance is a consolidation of Factory and Industrial Management (including "Factory") and Maintenance Engineering. Price 35¢ a copy. Publication office, 99-129 N. Broadway, Albany, N. Y. Address communications about subscriptions to Director of Circulation, 330 W. 42nd St., New York 18, N. Y. Subscription rates—United States, U. S. Possessions and Latin American Republics: $3, 1 year; $4, 2 years; $5, 3 years. Canada: $3.50, 1 year; $5, 2 years; $6, 3 years. Other countries: $5 or 30 shillings, 1 year; $8 or 48s, 2 years; $10 or 60s 3 years. Please indicate position and company connection on all subscription orders. Cable Address, "McGraw-hill, New York." Member A.B.P., Member A.B.C.

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Factory Management and Maintenance, September, 1945. Vol. 103. No. 9. Published monthly, McGraw-Hill Publishing Co., Inc. Editorial, executive and circulation offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, November 13, 1936, at Post Office, Albany, N. Y., under Act of March 3, 1879.

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OUTLOOK FOR MANUFACTURING AS RECONVERSION PROGRESSES

EVIDENCE IS PILING UP that manufacturing industry in reconversion from war is leading the nation on the road to America's greatest peacetime prosperity.

Despite the unexpectedly sudden end of the war with Japan, manufacturing has been able to sail through the shock of transition to peace without the slightest faltering. The same know-how in management that surmounted all kinds of problems to startle the world with endless tons of war goods has now shown startling ability to start the wheels turning in the production of the greatest flood of civilian goods in the history of peace.

Of immense importance was government's ready relinquishment of large areas of its wartime control over industry. While certain controls still held, the atmosphere was one which promised an early return to free economic competition and unrestricted production. Overshadowing these hopeful signs, however, was the prospect of widespread labor disputes as major unions drew their lines for a drive toward new high hourly wage levels.

Principal developments of the opening period of reconversion and the outlook for manufacturing in the immediate future are as follows:

1. Production. Flood of civilian goods begins to reach markets within 30 days after Japanese surrender. Experts predict boom is impending.

2. Employment. Predictions of large-scale unemployment are shown unfounded. FACTORY's survey of 60 companies indicates manufacturing industry employment has already rebounded to 28 percent higher than 1940.

3. Jobs Budget Bill. Controversial provisions of "full employment" legislation exposed by Congressional criticism. Bill faces probability of considerable amendment.

4. Unemployment Compensation. Kilgore measure to provide national standard of $25 for 26 weeks is shown unsound in parts. Extensive amendments to it are offered.

5. Minimum Wages. Bill offered Congress would raise old minimum of 40 cents hourly to 65 cents, and subsequently to 75. Compromise is possible.

6. Unions. Sporadic strikes continue to plague reconversion efforts. New flood of union demands for shorter hours and higher wages begins.

7. Veterans. Rate of demobilization to increase, hastening exodus of some present manufacturing workers.

8. Materials. Most materials already available in quantities exceeding last peacetime years.

9. Taxes. Reductions in 1946 for corporations and individuals, totaling $5,000,000,000, believed assured.

10. Facilities. Government encourages purchase of surplus plants, equipment, and machinery.

11. Controls. Price-squeezing by OPA against higher wages threatens to continue as a troublesome element.

12. Trends. Continued conflict between conservatives, liberals, and radicals is shown.

Production

SIXTY DAYS after the capitulation of Japan, production of civilian goods in American factories was increasing at a rate so fast as to astonish the prophets of gloom who had intimated to the public that "it couldn't be done."

Thousands of plants accomplished their reconversion almost overnight. Even among some of the giant industries in which reconversion was conservatively expected to be a 6-month job, there are numerous examples of high production achieved in 90 to 120 days.

Not all the progress is being reflected immediately by a corresponding improvement in retail stocks ready for the public to buy. In many lines it takes two to three months just to fill up the slack on wholesale and retail dealers' shelves. Typical is the case of Bendix Home Appliances, Inc., which was given a WPB go-ahead only a few weeks before the Japanese surrender. Bendix was able to begin shipments of washing machines in midsummer, but its first 8000 machines—ready within 30 days after the Japanese

surrender—were only enough to supply floor samples for dealers. Subsequent production was scheduled at 600,000 a year.

Likewise, seven weeks after General Electric Company started to reconvert one of its departments from production of bazookas to household washing machines, the first of its new washers were rolling off assembly lines.

Radio companies, although slower to get a civilian go-ahead from the government, were able nevertheless to be among the first to re-enter peacetime markets, and WPB predicted there would be 3,500,000 new radio sets in dealers' or consumers' hands between September 1 and the end of the year.

The durable goods industries also have shown themselves able to respond with speed to the needs of peace. There was hardly more than a momentary lull, for example, in the output of tractors, while production of machine tools maintained its customary speed.

The giant automotive industry also made fast progress within the limitations of two serious handicaps: (1) Lateness in being permitted to get adequate stocks of raw materials and tools, and (2) union labor strikes at bottleneck points. Nevertheless, the Automobile Manufacturers Association announced expectations that 500,000 cars will be produced during the remainder of 1945, and predicted that an annual rate of 6,000,000—almost double the pre-war average—will be attained by late spring or early summer of 1946.

Chairman J. A. Krug of WPB estimated that the value of civilian goods output by the end of the year might be as much as 12 percent in excess of pre-war levels. Dr. Emerson Schmidt of the U. S. Chamber of Commerce told the Senate Finance Committee that "we cannot help but conclude that a big boom is impending." And President Truman in a message to the Congress predicted "the greatest peacetime industrial activity" in the history of the nation.

Reconversion Rebound

• **Johns-Manville,** New York—Will spend $40,000,000 for expansion of factories and facilities, including 93-acre research center at Bound Brook, N. J.

• **Budd Manufacturing Company,** Philadelphia—Starts production soon on new type of railway sleeping cars.

• **Square D Company,** Milwaukee—Announces plans to double size of present plant for increased output of industrial electrical equipment.

• **Winchester Repeating Arms Company,** New Haven—Post-war operations will employ one-third more workers than pre-war level.

• **Symington Gould Corporation,** Rochester, N. Y.—To start $1,000,000 building and repair program as soon as possible.

• **Industrial Rayon Corporation,** Cleveland—Looking for a site to build new $25,000,000 plant; to increase rayon production by 30,000,000 pounds annually.

• **Worthington Pump & Machinery Corporation,** Holyoke, Mass.—Will produce air conditioning equipment in plant used for heavy ordnance.

• **Warner & Swasey Company,** Cleveland—Will add textile machinery as new product, supplementing machine tools.

• **International Harvester Company,** Chicago—Plans new plant on 320 acres near Fort Madison, Iowa, for production of farm implements including a mechanical cotton picker. Plans another new factory for farm tractors near Alton, Ill.

• **Westinghouse Electric Corporation,** Pittsburgh—Has appropriated $27,500,000 for factory improvements in connection with reconversion at Pittsburgh, Sunbury, Sharon, and South Philadelphia, Pa.; at Mansfield and Lima, Ohio; at Newark, Jersey City, and Bloomfield, N. J.; at Baltimore; East Springfield, Mass.; and Bridgeport, Conn.

• **Rustless Iron & Steel Corporation,** Baltimore—Will spend $2,440,000 for five building projects to help reemploy 1300 veterans on permanent basis.

• **American Car & Foundry Company,** Flemington, N. J.—Has $90,000,000 backlog of orders for regular equipment remaining after cancellations of war orders.

• **National Gypsum Company,** Buffalo—Work has started on $8,500,000 post-war expansion program, beginning with new plants at Baltimore. Other parts of program to be started quickly.

• **Ford Motor Company,** Dearborn, Mich.—Low point of employment passed at September 10. Jobs to increase steadily thereafter.

• **E. I. du Pont de Nemours & Company,** Wilmington—Will spend $10,000,000 for new production facilities for nylon products.

• **General Motors Corporation,** Detroit—Pontiac Division will expand plants to permit production of 500,000 cars per year, compared to previous peacetime rate of 330,061. Expansion includes 104 acres of enclosed production area.

• **Bell Aircraft Corporation,** Burlington, Vt.—Former aviation plant to be used for manufacture of textile, tobacco picking, packaging, and other machinery.

• **Nash-Kelvinator Corporation,** Grand Rapids, Mich.—Will spend $2,400,000 to install final assembly operation on refrigerators here.

• **Philco Corporation,** Philadelphia—Ground broken for new plant to contain longest continuous radio production line in the world. Will add 300,000 square feet of floor space and cost $1,000,000.

• **Monsanto Chemical Company,** St. Louis—Outlay of $48,400,000 planned for plant expansion.

• **A. O. Smith Corporation,** Milwaukee—Nation's largest producer of war bombs is now at top speed producing large diameter pipe.

Job Prospects Favorable

Spot telegraphic survey of employment in 60 typical manufacturing concerns, made by FACTORY early in September, reveals the following favorable factors:

1. Expected employment September 1, 1946 (56 companies reporting) will be only 25 percent less than the wartime peak.

2. Expected employment September 1, 1946 (56 companies reporting) will be 30 percent higher than the 1940 average.

3. Employment now (September 1, 1945—60 companies reporting) is 28 percent higher than average employment in 1940.

4. In only 8.5 percent of the respondent companies does reconversion affect more than 40 percent of their facilities and thus constitute a delaying factor (59 companies reporting).

5. Introduction of new products is expected to cause more than a 5 percent increase in employment in 17.6 percent (51 companies replying).

6. An increase of more than 5 percent in number of sales and distribution employees is expected during the next year in 56 percent of the 50 companies answering this part of the telegraphic questionnaire.

GLOOMY PREDICTIONS of large-scale unemployment during reconversion have no basis in fact.

Manufacturing industry's recovery from the shock of suddenly canceled war orders has been phenomenal.

Those are the outstanding conclusions from FACTORY's spot telegraphic survey. Other findings:

Principal declines in war industry employment had already taken place before Japan surrendered.

The wartime peak of employment did not come at any one period for all manufacturing plants.

A relatively high level of employment had been reached as early as September 1.

Employment expectations for 1-, 3-, and 6-month periods indicate maximum decline under 1 percent.

A year hence employment in factories will be 30 percent higher than average employment during 1940.

FACTORY's survey serves further to substantiate postwar job estimates made public late last month by the Committee for Economic Development (for details see Reconversion Communiqué No. 4 in August FACTORY). CED estimated that employment during the first full year after victory would be 33.6 percent greater than in 1939. Taking into account the fact that factory employment in 1940 was approximately 10 percent higher than in 1939, FACTORY's prediction of 30 percent over 1940 is thus slightly rosier than even CED's. Yet CED's figures, the Committee believed, not only would constitute the highest peacetime "quota" for manufacturing itself, but also would be enough to bear a full share in inducing practically 100 percent employment for the full labor force.

Noteworthy also is the evidence from FACTORY's survey that the employment rebound since the war's end – to an indicated 28 percent above the 1940 level – is already so high that a further improvement of only 2 percent is needed in the next 12 months, as a national average, to go considerably beyond the manufacturing "quota" of 13,500,000 as set by the CED.

However, since it is plain that industry will take back a large body of returning servicemen during the coming 12 months, it is easy to deduce that many employees who are still on manufacturing payrolls now will leave during this period to go into permanent retirement, resume household duties, return to school, or take nonmanufacturing jobs.

For complete data, see table on two following pages

EMPLOYMENT OUTLOOK OF

Case No.	Average in 1940	Wartime Peak	Date of War Peak	TOTAL FACTORY EMPLOYMENT Approximate, 8/1/45	Approximate, 9/1/45	Expected, 10/1/45	Expected, 12/1/45	Expected, 3/1/46	Expected, 9/1/46	Type of Product
1	575	750	2/44	500	510	510	510	510	650	Candy
2	1261	2925	6/43	2453	2453	2400	2400	2520	2520	Iron, steel
3	1905	4845		2935	2903	2900	2900	2900	2900	Machine tools
4	2306	6300	3/43	4250	4080	3680	3500	3500	3000	Machine tools
5	1550	2592	2/45	2390	2379	2379	2379			Refrigeration equipment
6	14,100	18,834	6/44	18,843	18,976	18,976	18,976	18,976	18,976	Glass
7	8000	17,500	11/43	13,900	13,498	13,500	12,000	10,000	10,000	Motive equipment
8	918	1467	5/43	1294	1289	1300	1350	1400	1450	Wire cable
9	6100	8800		7500	7600	7250	7000	7000	7000	Railroad equipment
10	950	1000	10/42	650	600	675	700	800	850	Pencils
11	2400	4423	4/43	3588	3551	3551	3551	3551	3551	Wool textiles
12	6800	14,947	11/43	11,213	8500	9000	9500	10,000	10,000	Floor covering
13	3750	5164	2/42	3642	3613	3300	3600	3700	5000	Hardware
14	18,900	19,400		18,700	19,400	19,400	19,400	19,400	19,400	Rayon
15	1437	1592	5/42	1428	1430	1500	1600	1600	1600	Paper
16	3679	2157	6/43	1411	883	1083	1583	1800	2400	Auto parts
17	38,191	55,131		41,811	41,249				41,249	Meat packing
18	7000	11,500		8300	8000	8200	8500	9000	9000	Business machines
19	964	6292	7/43	3406	2857	2500	2000	2200	2200	Engine parts
20	4200	4000	6/44	3850	3800	3825	4000	4100	4400	Chemicals
21	2188	2822	2/43	2505	2518	2550	2575	2700	2800	Cotton textiles
22	447	690	5/42	583	575	600	650	700	800	Writing pens
23	1471	3369	6/43	2643	2200	1800	2100	1800	1800	Machine parts
24	1950	1843		1800	1789				1900	Textiles
25	3572	3483	43	3357	3357	3357	3357	3357	3357	Soap, toilet goods
26	784	1440	9/43	1086	1081	1081	1000	1000	1000	Screws, bolts
27	410	1074	4/42	599	582	565	550	550	550	Screws, plugs
28	1770	2790	1/44	2562	2305	2100	2200	2250	2300	Watches
29	900	2850	7/43	1950	2000	2000	2000	2050	2050	Engine parts
30	350	1116	1/43	935	350	350	365	400	450	Electrical equipment

SIXTY MANUFACTURERS

Case No.	TOTAL FACTORY EMPLOYMENT									Type of Product
	Average in 1940	Wartime Peak	Date of War Peak	Approximate, 8/1/45	Approximate, 9/1/45	Expected, 10/1/45	Expected, 12/1/45	Expected, 3/1/46	Expected, 9/1/46	
31	1850	4823	6/44	3582	2850	2500	2800	2200	2400	Vacuum cleaners
32	800	1900	6/43	1550	1575	1675	1675	1725	1800	Tractors
33	843	1191	6/42	834	760	780	840	850	850	Asbestos materials
34	823	8300	1/43	6500	6500	6600	6600	6600	6600	Airplanes
35	5570	8904	3/43	7716	6900	6900	6900	6900	6900	Wire and cable
36	900	1425	4/44	1035	1009	800	800	1000	1200	Printing presses
37	1639	2769	5/43	1607	1669	1767	1787	1800	1830	Surgical supplies
38	1100	1622	7/45	1611	1607	1607	1607	1607	1607	Machinery
39	37,014	48,371	11/44	46,534	46,534	46,534	46,534	46,534	46,534	Chemicals
40	1752	3297	6/42	3024	3106	3300	4200	5000	5000	Building materials
41	343	725	6/45	707	667	667	667	667	667	Spices
42	3210	9303	12/43	5699	4151				5000	Auto accessories
43	681	861	6/42	619	624	643	662	682	702	Graphite products
44	1403	2649	6/42	1683	1750	1950	2150	2350	2350	Machinery
45	7000	6000	1/43	5747	5900	6000	6200	6400	6800	Thread
46	4004	11,066	10/43	7329	6980	7600	7900	8400	8800	Farm machinery
47	1127	1691	7/43	1310	1233	1270	1400	1500	1700	Paint and glass
48	13,077	12,035		12,325	12,267	12,500	13,000	13,750	14,200	Steel
49	2845	3274	4/42	2807	2854	2900	3000	3100	3300	Paper
50	1400	3213	3/44	3092	2590					Bearings, bushings
51	7500	44,842	5/45	42,000	23,400	15,000	11,000	10,500	10,500	Explosives
52	1186	1282	7/42	710	738	760	800	1000	1200	Portland cement
53	1126	3850	3/43	1870	1868	1968	2268	2268	2300	Electric motors
54	8300	23,200		16,000	10,500				16,000	Office machinery
55	791	3100	11/43	2750	1400	1500				Storage batteries
56	884	6234	4/45	5663	2055	2055	2250	2100	2500	Welding alloys
57	184	499	8/44	410	431	461	491	521	600	Lead tube containers
58	1201	1581	8/43	1477	1444	1500	1500	1500	1500	Rayon
59	1664	3731	11/43	2300	2262	2262	2262	2262	2262	Food products
60	272	527	3/43	326	214	200				Printing machinery

Employment

ALL KINDS OF ESTIMATES are freely offered these days in official and unofficial quarters concerning the supposed volume of current unemployment, most of which is said to be in manufacturing. An average of these estimates is about 1,400,000.

This ties in pretty well with War Manpower Commission reports from all parts of the nation, and with other reports from large industrial centers. However, there is some evidence to show not only that most of this unemployment is self-imposed by former workers who are slow to accept open jobs that are waiting, but also to indicate that the unemployment total should be charged to the whole national economy rather than just to manufacturing.

Among such evidence is FACTORY'S survey indicating that manufacturing employment now is about 28 percent greater than in 1940. This percentage shows the present volume as slightly in excess of 14,000,000 employees. Yet, if—as leading economists and the WMC suggest—14,000,000 is a fully satisfactory total in a time of fullest prosperity, then manufacturing even today has a condition of "full employment." The converse, obviously, is that it has no unemployment.

Actually this is not in conflict with known facts, as it first might seem to be. The truth is simply that in some localities, such as Detroit, the time required for reconversion still leaves considerable numbers of persons unemployed who previously held jobs in manufacturing, at the same time that manufacturers in some other localities, where reconversion was simpler, have responded to the pent-up demand for products by putting more people on their payrolls than their normal peacetime number. Thus, so far as manufacturing is involved, unemployment totals in some localities are largely "washed out" by overemployment in others.

With increasing recognition of the fact that millions of persons who have lost jobs are nevertheless *not* unemployed—either because they have found new jobs or have completely left the labor market—official reports of current unemployment have become increasingly cautious. A statement by the WMC, for example, asserting in September that "2,100,000 workers have been displaced from war employment," hastens to add to the same sentence that this figure "does not represent an unemployment estimate as of this date, since an undetermined number of these workers have already been reemployed." The WMC merely neglected to add further that an additional number have left the labor market entirely, principally for schools, housekeeping, and old-age retirement.

Jobs Budget Bill

SHARING TOP POSITION among legislative proposals on the agenda of Congress this session are the Murray Full Employment Bill and the Kilgore Unemployment Compensation Bill. Both have the backing of President Truman, but face the probability of extensive amendments before reaching the status of a final vote.

The Murray Bill, which would authorize the President to maintain a constant "job budget" for the nation, and report to Congress at any time it appeared there was danger of large-scale unemployment, so that a public works program could be used to create as many jobs as needed, was widely attacked by members of the manufacturing industries and others. Everyone agrees that "full employment" is desirable—just as everyone agrees that "sin is sinful"—but there was wide disagreement that the Murray Bill would be helpful to the nation. Three major angles of attack were these:

1. That it would be too easy for a political party in power to make an exaggerated estimate of total jobs needed and then use those figures as an excuse to operate a "perpetual WPA" as a means of winning votes from several million boondogglers.

2. That the psychological effect on the nation coming from a Presidential announcement predicting that mass unemployment threatened the nation would cause a reduction in spending by consumers and investors, and thereby cause a depression even if none had really been threatened.

3. That the greater the number of persons put in governmental jobs of any kind, the greater is the tax burden carried by all the other people of the nation. Thus, the amount of money spent on public works programs is approximately offset by a corresponding reduction in the amount of money that can be spent by taxpayers for all other purposes—with the result that public works spending prolongs rather than cures a depression.

Proponents of the Murray Bill, many in complete sincerity, insisted that objections to the measure were faulty and that the sole purpose of the legislation was to provide a backstop or cushion for private enterprise, so that a temporary lull could never become a full-blown depression.

Compensation Bill

OPPOSITION to the Kilgore Bill was similar to that which faced the Murray measure. In addition, however, the opponents pointed out that the Kilgore proposal to provide federal funds so as to lift state payments of unemployment compensation to a standard maximum of $25 a week for 26 weeks would provide a "luxury" level of living in some states, but considerably less than such a level in others.

Proponents of the bill claimed it provides adequate safeguards against persons "faking" unemployment by requiring them to stand ready to accept any job offered them, but opponents said that if millions of persons—such as housewives—were simultaneously to simulate readiness to accept employment, they would so far exceed the normal number of job openings that there would be no way to call their bluff, and they would be paid compensation for an unemployment that was wholly fictitious.

As amended by the Senate Finance Committee, the Kilgore Bill later provided for compensation to be left at various levels fixed by the individual states, ranging from $15 to $28 weekly, but for federal funds to supplement state appropriations wherever necessary to extend the payment period up to a maximum of 26 weeks from the previous time limits of the states, which in some cases were as short as 14 weeks.

The amendments also called for travel allowances up to $200 to be paid to displaced war workers to take them

back to their *bona fide* homes, or to take them to other employment provided the cost was not greater than that for home-coming. Provision to pay transportation of household goods also was under consideration.

Minimum Wages

OTHER LABOR LEGISLATION prepared for action of Congress includes the Pepper-Hook Bill to set a new and higher national standard for minimum wages, and Senator Rankin's efforts to exempt war veterans from compulsory union membership in closed shops.

The minimum wage revision as proposed would supplant the former 40-cent hourly floor with a 65-cent minimum for 44 hours a week for one year, then go up to a 70-cent minimum for 42 hours for a second year, and move up to 75 cents an hour for 40 hours weekly in the third year.

Sponsors of this bill estimated that 10,000,000 workers would benefit from it in the form of increased wages.

President Truman, calling for an increase from the old 40-cent minimum, said in his recent message to Congress that adoption of a higher minimum is needed to offset hardship inequities in exceptional low-wage groups, caused by increases in the cost of living. He added also that the new Fair Standards Act should be expanded in scope to include agricultural processing workers and some others.

"There now exists a twilight zone in which some workers are covered and others doing similar work are not," he said. "Extension of coverage would benefit both workers and employers by removing competitive inequities."

In addition to the foregoing measures, Congress also had before it the Ball-Burton-Hatch labor bill to rectify objectionable features of the Wagner Act. Faced with the full force of organized labor's opposition, however, the reform measure was not given much hope of adoption in the opinion of well-informed Washington legislators and observers.

Unions

SPORADIC OUTBREAKS of strikes continue to plague industry's efforts to get production machinery back into high gear. As expected, the worst of the labor turmoil centers around the militant automobile workers' unions.

Thus the very points—Detroit and other automotive centers—where the most "unemployment" exists are the places where strikes are throwing monkey wrenches into job-creating procedure.

A strike of 12,000 "white-collar workers" at Westinghouse plants also has provided an incident worthy of wide interest. Here an independent union produced the walkouts, contending that salaried white-collar workers are just as much entitled to bonus payments as wage-earners in the shops. Novel result of this strike was that it caused plant shutdowns and stopped the earnings of CIO "backshop" unions which were not on strike, and even tied up the preparation of payroll payments.

On other labor fronts the initial period of reconversion is being seized as an occasion for a flood of union demands for shorter hours and higher wages. Typical is a manifesto issued by United Rubber Workers at the Firestone and Goodyear plants in Akron, declaring that "the 30-hour week is a prime necessity if we are to avoid the most acute unemployment crisis in history." The manifesto added that wages must be kept up to wartime levels to maintain buying power.

Among other union campaigns for higher wages now in progress are the demands of the Brotherhoods of Locomotive Engineers and Trainmen for a minimum increase of $2.50 a day, and of the CIO United Steel Workers for a minimum increase of $2 a day.

At the Goodrich plant another complication to reconversion arose when several hundred members of the Foremen's Association of America went on strike, insisting they are not part of management but are employees within the meaning of the NLRA.

A national conference of management and labor representatives probably will be held within a few weeks, at the call of President Truman, to seek some means of ending the labor-management phase of economic confusion.

Veterans

RETURN OF VETERANS to the status of civilians—and job-seekers—probably will be sharply speeded up within the next few weeks. By that time the greatly reduced need for occupation forces in Japan, Germany, and in lesser areas will be too plain to permit much stalling. Already Congress is under increasing pressure to "get the boys home as soon as possible."

Demobilization will be stepped up to close to 800,000 a month, provided sufficient transportation facilities can be provided. One inevitable result will be the ousting or voluntary retirement of many persons now holding jobs in the manufacturing industries, perhaps as many as 250,000 a month. Possible point of friction here involves the still-debated job priorities of returning veterans of this war and their seniority status. Also, on the whole broad front of unionism, the closed shop, and picket lines, the extent to which returning veterans will be sympathetic or hostile still remains to be seen. Perhaps as a group they will have a more enlightened view of economic issues involved in employer-employee relationships than has been the national average in recent years. It is a possibility that is well worth considering.

Washington circles expect General Hershey, representing Selective Service, and General Bradley, director of Veterans Administration, to ask Congress for supplementary legislation to clarify the seniority status of veterans, and to provide for general job preference to include veterans who never have held jobs.

Materials

FURTHER IMPROVEMENT in the availability of raw materials for industry will be experienced from now on. With a few exceptions, most of the major materials already are available in quantities considerably exceeding the last peacetime year.

Steel. Production now around 80 percent. Output tonnage about 15 percent greater than highest previous peacetime year. Reconversion of excess plate capacity to strip and sheet mostly completed and in operation. Industry rapidly

extricating itself from confusion caused by initial avalanche of cutbacks and new orders following Japanese defeat.

Non-ferrous metals. All major varieties available in adequate quantities except tin. Some tightness also remains in lead. Substitutes for tin will continue to be necessary in some kinds of products for several months to come. Rush job of rehabilitation planned for tin mines in Malaya following evacuation of Japanese.

Rubber. Resumption of large scale imports of natural rubber will come more quickly than previously expected. First reports indicate plantations in South Pacific areas previously occupied by Japanese are in improved condition as result of long period of "rest" in bleeding of the trees. Production of synthetic rubber continues not far short of meeting normal American needs.

Lumber. Only a slight increase in sawmill output so far, but a considerable increase in shipments for civilian orders owing to large declines in demands for military purposes. Dealer stocks improving, and construction industry confident enough lumber will be available not only for plant construction and as a raw material for manufacturing wood products, but also to supply full needs of residential construction within the limited speed which is possible in early winter weather.

Textiles. Improvement already sufficient to account for lifting of such controls as restriction to short-tail shirts. Consumer buying by returning veterans will continue to keep retail supplies tight despite expanding production.

Fuel. Coal stocks remain about 30,000,000 tons below 1943 average, but factories will have enough even if it is necessary to keep residential consumers on short rations this winter. Fuel oil and gasoline relatively plentiful.

Taxes

REDUCED TAXES for corporate, individual, and excise taxpayers are virtually certain for 1946.

Specifications written into a tentative new tax bill call for a reduction of approximately $5,000,000,000 in income payments, including about $2,500,000,000 on corporate incomes.

Secretary Vinson and most members of Congress are favorable to some form of reductions. While some groups will want to conceal the cost of government as much as possible by indirect taxes on the public applied through industry, there even was good prospect that industry's load will be lightened in the final bill.

Facilities

INCREASINGLY LARGE AREAS of ready-to-use factory space are becoming available as government agencies expedite the reclassifying of government-owned plants as surplus property. About 400 large plants already have been declared surplus by the Army and Navy, representing an original cost of $2,500,000,000.

Surplus Property Board officials express keen desire to cooperate in getting these plants into job-producing use. A newly-issued SPB regulation (No. 10) asserts that "emphasis shall be placed upon the urgency of getting plants into civilian production immediately so as to provide maximum employment." It instructs SPB negotiators to "seriously consider offers to purchase or lease which will result in a lower monetary return if the applicable objectives of the act will be better attained thereby."

While the machine tool industry is doing its utmost to supply manufacturing with huge quantities of equipment needed for reconversion, SPB also is urging manufacturers to look more thoroughly into surplus machinery now available through RFC and other disposal agencies. Army officials recently listed for disposal 33,158 pieces of machine tools and other production equipment with an original cost of $150,000,000.

Controls

ALTHOUGH MANY OF THE CONTROLS established by government over industry during the last decade will continue in effect for indefinite periods, most of the wartime controls have been dropped, and the few remaining are scheduled to end within the next few months.

Only three types of WPB priorities on materials remain, and they will be used sparingly: AAA for general emergencies; MM for military needs; and CC for serious but rare bottlenecks in civilian production.

The OPA, however, has threatened to continue ration controls on the sales of automobiles and a number of other products; also it hopes to continue leaning with a heavy hand on price ceilings—squeezing manufacturers, wholesalers, and retailers against labor's ever-insistent demands for higher wages. One exception permits wage increases up to a 55-cent hourly level even if this affects final prices.

An effort also has been begun by the War Labor Board to get out from under the swamping effect of 3000 cases of pending labor disputes. To do this, WLB has requested all disputants to "try to settle all or some of the issues by a resumption of collective bargaining, submit them to voluntary arbitration, or agree to a shortened procedure for final disposition by the board."

Trends

PRESIDENT TRUMAN'S message to Congress covering "full employment" and various other matters is widely interpreted by New Dealers and anti-New Dealers as disclosing that he is definitely allied to the "spend and spend and tax and tax" school of political-economic thinking. Truman, however, has not admitted it is so . . . A bill to provide federal subsidies for creating or expanding industries in "under-developed" areas has been proposed by the Departments of Commerce, Agriculture, and Labor . . . A local union of Sand Hogs and 264 members have sued the International Hod Carriers, the Building and Common Laborers Union, and two officials for $2,640,000, alleging the defendants conspired to deprive the plaintiffs of their jobs . . . Both AFL and CIO expect to appeal to the Supreme Court on two rulings of federal courts in Florida which upheld the State Constitution in prohibiting the closed shop in that state.

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FACTORY
MANAGEMENT AND MAINTENANCE
L · C · MORROW · EDITOR

For All-Out Peace Production

Among all the uncertainties of the transition from war to peace, one thing stands out clearly: Industry has a low-cost production job to do. This job can be very difficult or it can be relatively easy, depending upon the proscriptions within which it must be done.

Conditions will not be the most favorable, in all probability.

It still is believed by too many influential people that arbitrary raising of wages will provide the purchasing power for an economy of great magnitude, if that raising is carried far enough.

It still is believed that most, if not all, of the difference between high wages and fixed prices must come out of profits.

It still is believed that deficit spending can bring about full employment under a private enterprise economy.

Affirmative action based on these beliefs is politically popular. High wages, low prices, and guaranteed jobs. What an appeal the combination has. How difficult it will be for anyone to be against any one of these objectives.

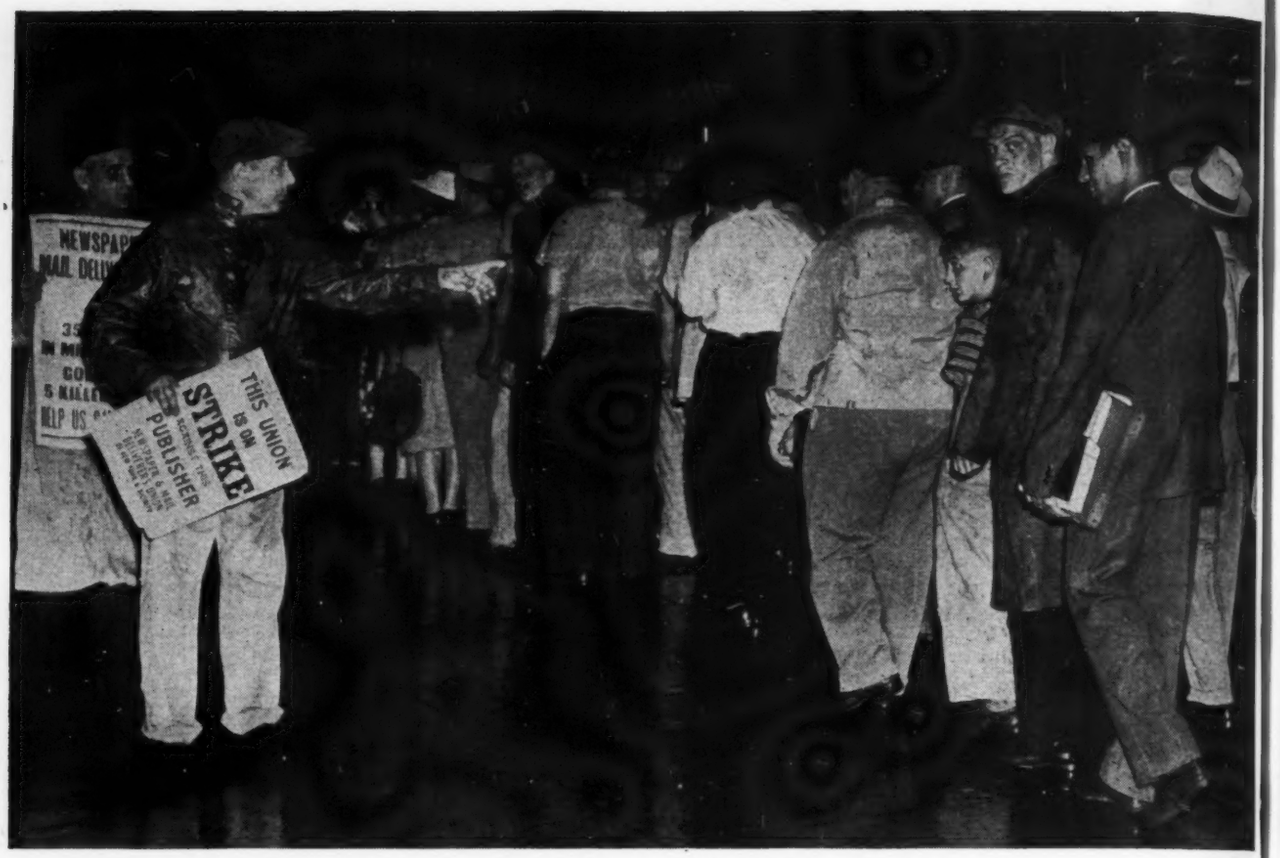
Of course everybody is for all of them if they can be achieved. The higher the wages the better, if earned by commensurate production. The lower the prices the better, if lowered because of economies in manufacture and distribution. And when this cycle of high production, high wages, and low prices is in full operation, we are certain to have jobs for all and a standard of living that is always rising.

Given the right atmosphere, industry can do miracles, as proved countless times during the past four years. It can win the peace as it did the war. General Electric's Wilson has said it: "Scientific progress and productive efficiency are the most wonderful weapons of all times, because they do not have to be laid aside when the fighting ends. They must not be laid aside. Industry and labor, with the full cooperation of our government, must begin at once to apply them to the problems of peace and reconstruction."

Senator Vandenberg has proposed a conference of representatives of management and labor under government sponsorship. If these representatives could be convinced of the truth of the production-wage-price-job relationship, and its controlling influence upon the mutuality of interest of management and labor, it would make little difference whether or not Congress passed the "full-employment," 65-cent minimum wage, and other labor bills.

If that conviction were to come about, there would exist the most favorable atmosphere for an era of unprecedented peacetime production. Probably some measure of understanding will be achieved at the conference, and it will be helpful. But even if no progress at all is made, the manufacturing part of industry will still have its low-cost production job to do.

L C Morrow



Pickets and newspaper-buying throngs meet outside Daily News Building in New York news handlers' strike

Royalties f

SHALL INDUSTRY AND THE CONSUMER help defray the cost of running the unions? Shall the purchasers of industrial products pay an involuntary tax, over and above federal social levies, to provide extra security for special groups of workers?

These are the basic questions back of union demands for "royalties" and other forms of forced employer "contributions" to union welfare funds. This type of demand is cropping up with increased frequency. Is it a flash in the pan? Or is it a "sleeper" which bids fair to rank among outstanding objectives which labor will pursue in the coming years?

By all the signs, management cannot dismiss lightly today's trend toward welfare payment demands. They may shape up as more, much more than a temporary "fringe" evasion of wage stabilization. Here are the signs:

1. Petrillo. The trend was launched when James Cesar Petrillo and his American Federation of Musicians defied the President of the United States and gained a "royalty" payment for "the relief of unemployed musicians" on the sale of phonograph records and radio transcriptions.

2. Lewis. The trend gained strength when John L. Lewis and his United Mine Workers presented, then dropped, a demand for a royalty of 10 cents a ton on coal in the anthracite negotiations last spring. This may have been a trial balloon or a mere Lewis diversion. On the other hand, Lewis may return to the point in dead earnest another time.

3. New York news strike. The real crux of the recent strike of New York newspaper handlers was a variation of the royalty idea. The union demanded payment by the publishers of 3 percent of the payroll to a union "welfare" fund. This was the issue on which negotiations broke down, and it is still unsettled.

4. Printers' strikes. A similar demand, for 2 percent of payroll, is a

New York news strike spotlights growing demand for "welfare" payments. Petrillo started it. Lewis took it up. And it's spreading fast. Does the public see the real meaning of a tax on production to finance extra security for special groups? Does management see the real effect of payments which, finally, swell union war chests?

s for Unions

feature of at least seven current newspaper strikes called by the International Typographical Union which apparently has made a definite national policy of going after this type of payment as a major objective.

5. **American Federation of Labor.** The whole principle of enforced welfare payments by employers is warmly advocated by Joseph A. Padway, counsel to American Federation of Labor. Inferentially he urges the membership to seek this objective in an article, "Are Royalties Wrong?" in a recent issue of *The American Federationist*, official AFL magazine. (See "What's New About It?" on page 88.) Padway was counsel to Petrillo's union.

6. **United Auto Workers.** A CIO trend in the same direction was noted recently when the United Auto Workers' executive board authorized a demand for a 3 percent employer payment to a union "social security fund" as one of the points to be raised in negotiations.

7. **Government policy.** The War Labor Board will not actually order a negotiated welfare payment to a union, but it does not regard such payments as a violation of wage stabilization and it will approve them when agreed upon by employer and union.

8. **Public opinion.** Recent opinion studies suggest that an overwhelming proportion of labor leaders look with favor on the royalty idea, or some variation of it, and that the public tends to be sympathetic toward any demand linked with the generally worthy aims of worker security.

Worthy Aims Conceal Real Effect

The outward innocence of the "welfare" type of demand makes it doubly difficult to combat. No one wants to appear in opposition to such humanitarian things as health protection, unemployment insurance, and old age benefits.

A large number of employers, in fact, have voluntarily initiated welfare plans,

1. RECORDS →

Audacious James Cesar Petrillo, head of the American Federation of Musicians, touched off today's trend toward demands for "royalty" payments to unions. Petrillo forced makers of phonograph records and radio transcriptions to pay a fixed fee to the union on each recording made and sold, for the relief of "unemployed" musicians. Although no unemployed musicians could be found, and despite the fact that Petrillo's union membership had risen from 118,000 in 1932 to 134,000 in 1942, Petrillo defied the War Labor Board and the President of the United States to gain his point

Press Association photographs

2. COAL →

John L. Lewis, the no less audacious head of the United Mine Workers, next gave the trend a push, though he didn't follow through, by demanding a 10-cents-per-ton royalty on coal during last spring's anthracite negotiations. This would bring $50,000,000 a year into the UMW coffers for health and welfare benefits, and, said Lewis, "economic protection." Employers thought this might mean strike funds—and an added chance for UMW to make organizing invasions into new industries. Since then, adaptations of the "royalty" idea have spread to the newspaper industry. A demand for 3 percent payroll payments by employers to the union for welfare purposes was the crux—as yet unsettled—of the recent New York news handlers' strike

with and without union participation.

But voluntary welfare payment by employers to employees is one thing. Involuntary payment by employers to the unions is an entirely different thing. The surface difference isn't great. But the underlying difference—even when the union crosses its heart and hopes to die if it uses the welfare funds for anything but welfare—is basic and big. It comes down to this:

Every new revenue which a union can coax into its coffers for one purpose represents, finally, just that much more revenue which it can devote to other purposes.

Most unions, after all, assume some obligation for welfare payments to members. That's one of the unions' stated aims. Now suppose they can make employers carry the entire cost. Then eventually they will have just that much more to spend for organizing purposes, strike funds, political activity, or (in the case of the wrong kind of union) the sheer aggrandizement of the officers.

Moreover, the whole approach of the welfare demand tends to glorify the union at the expense of the employer. It throws the obligation entirely on one, the credit on the other.

Suppose, further, that the welfare agreement stipulates that benefits are to be paid only to "members of the union in good standing." Doesn't that artificially strengthen the union's position in the plant? And isn't the union asking the employer to foot the bill? That stipulation isn't inconceivable. It has been asked specifically in one set of proposed union demands. And another union has gone even further and asked the employer to take over part of the burden of paying the employees' union dues—in the name of welfare.

Consumers—and Unions Too—May Suffer

Finally, these enforced welfare payments would, in many instances, have to be passed on by the employer to the consumer. This would certainly be true of the 10-cents-per-ton royalty on coal. Thus, willy-nilly, a textile worker earning $30 a week might be forced to provide for the old age of a coal miner making twice as much. And every coal consumer would be asked to support the political activities of a union of which he may, or may not, approve.

Now here is a paradoxical question on which labor itself would do well to reflect:

Does a member of one union want to help finance another union's attack on his own?

This *could* happen. Suppose Lewis got his 10-cents-per-ton royalty. Any CIO member who bought coal would have to pay it. Lewis's UMW (District 50) and the CIO are bitter organizing enemies. So every time a CIO member bought 10 tons of coal he would be handing Lewis a dollar with which to destroy the CIO.

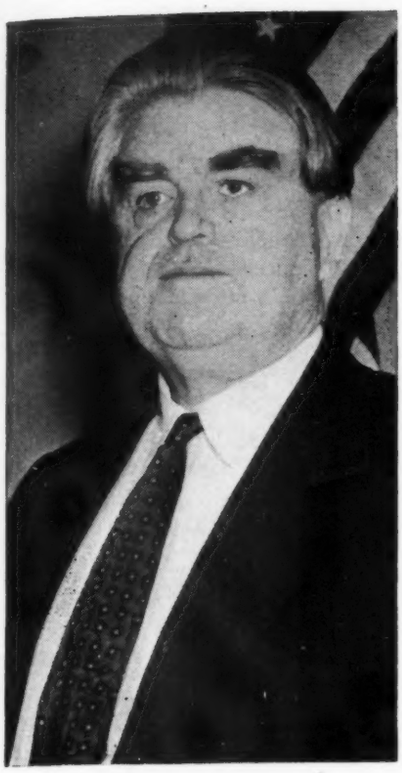
This is no joke because the coal royalty would place huge sums—$50,000,000 a year in the war years, half that sum in normal times—at Lewis's disposal. And Lewis offered no guarantee in his demand that the money would be spent exclusively for health, welfare, and old age benefits.

He also mumbled something about "economic protection." At the time, in fact, *Coal Age* observed:

"No matter for what purpose Lewis publicly says the fund would be used, the fact remains that it *could* be used to organize other industries, for political purposes, or for anything covered by the sweeping generality of 'economic protection'."

How Petrillo Fired the Powder Train

If there were any chance that public opinion would react against the real dangers of the trend toward "royalties," industry might breathe easier



3. AUTOS →

Walter Reuther, vice-president of United Auto Workers-CIO, may carry the spread of the idea still farther. The UAW executive board voted in April to include among new bargaining points a demand for payment by employers of 3 percent of payrolls into a union-administered welfare fund. Benefits would be restricted to union members "in good standing" and thus help UAW to increase and maintain membership. Union, hard pressed financially, now has few funds of its own to spare for welfare purposes. Reuther, as UAW negotiator, would carry the demand first to General Motors

about it. But Lewis caused no great outcry, nor did the now historic Petrillo case, despite the truly preposterous character of Petrillo's demands and the audacity with which he carried them into effect. Of course, the record industry's troubles may have seemed remote at the time, but it now becomes clear that Petrillo touched off a powder train which may yet blow industrial relations sky high in the manufacturing industries.

It all began back in June, 1942, when Petrillo felt a strike coming on. Forthwith he ordered all members of the American Federation of Musicians to cease making music for transcriptions and recordings to be played on the radio and in phonographs and juke boxes.

The singular thing about the strike was this: When he called it, Petrillo had no idea why. The strike notice was not served on the band leaders who are the nominal employers of the musicians, but on the record-makers with whom Petrillo's union had never actually engaged in collective bargaining. Since there was no contract, there were no grievances to be settled, no adjustments to be made. Wages and working conditions were admittedly excellent. There was plenty of work for all musicians. The "striking" AFM members easily found new engagements.

So, having paralyzed an industry, Petrillo began casting about for an issue. One day a great light dawned —and he launched his demand for payment *to the union* by the recording companies of a royalty, beginning at a quarter of a cent on a 35-cent record, into a fund for relief of all unemployed musicians.

There was a certain specious merit in Petrillo's claim. It is true that, back in 1930, some 18,000 musicians were thrown out of work by "canned" music in the form of talking motion pictures. And, on the surface, it still seemed that musicians were being displaced by juke boxes and wired musical devices.

Petrillo Couldn't Prove "Unemployment"

Actually Petrillo was never able to prove, and never made any serious effort to prove, that there was any substantial unemployment among musicians. The case eventually found its way into the jurisdiction of the War Labor Board. And a WLB panel, while praising Petrillo's personal integrity and candor, found that "the union has offered no statistics, objectives, or plan to support his demand for funds to relieve unemployment."

As a matter of fact, a spot survey in four principal cities revealed 94.5 percent of musicians employed and 5.5 unemployable. The membership of the AFM had risen from 118,000 in 1932 to 134,000 in 1942; the union's total cash receipts were already running about $3,000,000 a year; and the musicians engaged in making transcriptions were receiving $10 to $18 an hour. Moreover, it came out that more than 60 percent of AFM members merely make a sideline of music, playing nights and Sundays, and gain their real livelihood elsewhere. Membership in the union is ridiculously easy to obtain, by the way, and the union's definition of an "unemployed" member who might presumably qualify for its benefits was gloriously absurd. Said the union, "If a man is not working full time at music, he is an unemployed musician."

The "strike" dragged on for a couple of years during which an anti-trust action against the union was launched and defeated and a Senate committee called Petrillo in to hear the details of his royalty proposal.

Dangers of Political Use Cited

One of the major recording companies, Decca, broke ranks and settled with the union on Petrillo's terms;

the other principal companies, RCA-Victor, National Broadcasting Company, and Columbia Recording Corporation, slugged it out in the WLB hearings. On December 9, 1943, these companies filed a memorable brief. Some of its contentions, because of their pertinence to all subsequent similar disputes, deserve to be recorded here. For example:

"The employers submit that, in considering the union's proposal, its past history and organizational nature are most material to a consideration of whether that proposal was made in good faith for the purpose of alleviating unemployment, or whether there is not behind it *the desire of union officials to have available to them millions of dollars for disbursement by them in the interest of internal political strength.* The suggestion that the funds received will be used for the sole purpose of giving concerts throughout the country is not a complete answer to this last question. Even if they were so used, the fact would still remain that the disbursement of those huge funds, left to the discretion of a few union officials, would place in their hands a weapon of immeasurable strength for their own self-perpetuation in office and for other internal political ends."

And, from the same brief:

"If the union is successful in establishing the funds which it demands, and a man can obtain relief merely by joining, the union's membership would be inevitably increased. The result would be that the demands of the union will become greater and greater —the more money available, the more men that will join the union—the more men in the union, the more money required to take care of them."

Also this:

"The payment to the union of a royalty on all phonograph records and library transcriptions (80 percent of which are used in homes) would result in higher cost to the consuming public, reduced sales, and lessened employment opportunities for musicians and others." (In this connection the brief cited a statement by Petrillo in a union magazine, in which he said: "If these companies were permitted to increase the price of records anywhere from five to ten cents each, then the Federation would probably receive in the neighborhood of from $15,000,000 to $20,000,000 a year.")

And finally (after pointing out that Section 8 of the Wagner Act prohibits employers from contributing financial support to a union):

"This principle, if established here, would spread and put into the hands of many unions tremendous sums of money that would make them absolutely independent of their members or of government."

Despite all this, it is a matter of historical fact that Petrillo successively and successfully defied the War Labor Board and the President of the United States. At a press conference the President said there probably was a law that could stop Petrillo, but that he, the President, couldn't find it, and if he couldn't, who could? If there is such a law, no one has found it since.* And today millions of dollars are rolling into the Petrillo treasury for the "relief" of thousands and thousands of busily and happily employed musicians, full and part-time.

If Petrillo Can, Why Can't Lewis?

The question is: Can any legal steps arrive in time to undo the Petrillo precedent? John L. Lewis carried the trend further and may carry it further still in view of its obvious coincidence with his broad political aims. Lewis's first royalty demand was coupled with the superficially attractive objective of providing "modern medical and surgical service, hospitalization, insurance, rehabilitation, and economic protection" for the miners.

Most of these worthy activities are things with which no one could quarrel. In good years, such a fund might provide between $130 and $150 per miner per year, which would be equal to about 20 days' wages. It might raise the cost of coal production an estimated $400,000,000 a year. But at least, if used exclusively for social benefits, it would confer a high standard of security upon the miners.

"Economic protection," however, may have a host of meanings. For example, it might mean strike benefits. If so, then, at the very least, Lewis would be asking the mine operators to finance strikes against themselves, with the public to share the cost. Moreover, the United Mine Workers includes the great, sprawling, catch-all District 50, which has jurisdictional aspirations in every branch of industry. Nothing would give greater leverage to District 50's organizing assaults on other unions than a lush strike fund. The competing unions would, in self-defense, have to seek the same sort of "economic protection." So it is not inconceivable that, carried far enough, the "royalty" principle might find employers and the public in the unwilling role of financial backers of a gigantic new labor war.

There is nothing in Lewis's record to suggest that he, any more than Petrillo, would hesitate to defy any authority that stood between him and his objectives. So his future moves in this direction will be worth watching.

The Important New York News Strike

Certainly the War Labor Board, which occupies an unhappily ambiguous position with respect to the whole issue, offers a slim barrier to the spread of the "welfare" type of union demand. The Board has officially failed to perceive that such demands might amount to a hidden wage increase. If it entertains any views on the broader implications of the issue, they are favorable, as evidenced by its willingness to approve such agreements when jointly reached.

This lends significance to the New York news handlers' strike, whose outcome may set a favorable stage for Lewis and any other union leaders who are planning to pursue the proposal in their own behalf.

The New York Newspaper Mail Deliverers Union is a tight little independent whose 1700 members have set up a closed shop so rigid that new members must be the sons of existing members—the "legitimate male issue," in the language of the bylaws.

By violating the no-strike pledge, and by defying the War Labor Board, the union showed itself well able to halt the distribution of newspapers to 13,000,000 readers in the metropolitan area for a period of over two weeks. In pre-strike negotiations the union and the publishers had come to terms on issues of pay (an average take-home of $80 to $120 per week), vacations, and hours (reduced from a basic 40 to 37.5 per week).

The negotiations then broke down over the union's demand that the publishers pay 3 percent of the payroll into

* Senator Bailey (D-N. C.) did introduce a bill to outlaw enforced royalty payments, but it has not attracted much support and probably will not.

Photograph by courtesy of Ford Motor Company

If fixed payment of welfare funds to the unions can be gained in the automobile industry, it can spread to any type of manufacturing. Such a "demand" has been placed among coming issues by United Auto Workers-CIO while some union leaders have talked casually of a "royalty" to labor of $10 per car

a union welfare fund to provide the members with hospitalization, health insurance, old age pensions, and kindred benefits. It is worth noting that, from its dues of $48 a year per member, the union had already established such a fund from which it paid $83,000 for sick, burial, and pension benefits to members last year.

The union, to be sure, agreed to submit the new fund to administration by trustees either chosen by the union or by the union and the publishers acting together.

Nevertheless, the union was inviting the employers to "tax themselves"—as it candidly stated the case in its own words—for the benefit of its members. The sum involved was not a large one, amounting to $150,000 a year, to be prorated among eleven publishers. The union was also able to point out that the publishers' revenues had been greatly increased by recent advances in the prices of newspapers.

In 61 days of strenuous negotiations, however, the publishers resisted the welfare fund demand. They pointed out very properly that it represented a hidden wage increase and that, if granted to the Deliverers' union, it would soon be demanded by all the other unions in the industry. It was on this issue that the strike was called.

When the strike ended (the union having been threatened by WLB with the loss of all its bargaining rights), the real issue remained to be solved. All unsettled questions, including the 3 percent welfare demand, were tossed to WLB's Daily Newspaper Commission for hearings which began in Chicago on August 2. It seemed possible then that the 3 percent welfare issue might be submitted to arbitration.

The Newspaper Cases Significant to All

What *A* gets, in labor relations, *B* soon wants. The significance to all employers of the New York news handlers' case cannot be discounted. Moreover, a rash of similar demands has broken out in other branches of the newspaper industry. There were no less than fifteen dispute cases involving the same principle on the Newspaper Commission's docket when the new hearings began. And at least one publisher had capitulated in a private settlement.

The International Typographical Union is apparently out to make a national objective of welfare percentage payments. An example is the ITU strike against *The Jersey Journal* of Jersey City and the *Bayonne Times* of Bayonne, N. J. The welfare demand was not a part of the original negotiations between the locals and the publishers. But the International stepped in and injected—as it has in other cases—the demand for a 2 percent payroll contribution from employers for security and welfare purposes.

Additionally, the ITU is asking the publishers to take over the 50-cents-per-month dues assessment which members have long paid for support of

WHY ROYALTIES ARE DANGEROUS

Arbitrary fixed payments to unions by employers for welfare funds, either as "royalties" on production or as a percentage of payroll:

1. Often put the employer in the position of helping to finance the union. Every cent the union can get for one purpose represents a cent it can use for other purposes—organizing, strike funds, and politics.

2. Sometimes pass on to the consumer the cost of extra security for special groups of workers.

3. And could put the unionized consumer in the position of helping to pay for another union's counter-organizing attacks on his own union.

the union's big Denver sanitarium. This would greatly strengthen the union's finances because the sanitarium has long been a heavy drag on its revenues.

Auto Union Prepares 3 Percent Demand

First records, then coal, then newspapers. The widening scope of union welfare demands was bound to spread into the manufacturing industries. And sure enough, in early April, the executive board of the United Auto Workers-CIO went on record in favor of a new demand to be submitted to the automotive manufacturers, beginning with General Motors.

Key point of the program was payment of a fund of 3 percent of payrolls by employers into a welfare fund to be administered by the union. No payment by employees would be required. Generous casualty and death benefits would be provided for participating employees through policies to be underwritten by the Trade Union Accident & Health Association of New York.

To employees the plan would have many appeals: 60 percent of weekly wages for lost time—after the first week—due to accident or illness, for 51 weeks; death benefits of at least $1500, more for accidental death; a fund for hospitalization, medical services, eye correction, tubercular care, and the like, of $4,000,000 a year; free vacations. To the union, hard-pressed for funds and already running in the red, the plan's appeal would be equally obvious.

Plus this: A worker's eligibility to participate in the benefits would depend, according to the proposal, on his "membership in good standing" in the union—a distinct advantage to the union in increasing and maintaining membership.

Since the announcement, UAW hasn't carried the project very far forward. Perhaps it won't. A good many of its "demands" begin and end in the newspapers. The fate of this particular one won't be known until contract negotiation time rolls around. But it's a straw, to say the very least, that strongly suggests the direction of the national wind.

What's New About It? AFL Man Asks

In an article, "Are Royalties Wrong?" in *The American Federationist* for April, 1945, Joseph Padway, AFL counsel (and counsel to Petrillo's union in the record royalty case) takes umbrage at the assertion of employers that the royalty proposal is "new and revolutionary."

"Why a proposal should be objectionable because it is new is difficult to understand," Padway says. "But even this contention was untrue. The fact is that the proposal is new only in the sense of the form it takes. It is merely an extension of a principle that has been accepted and applied for some time now in various situations."

It is true that a good many company agreements are on record in which generous benefit payments are made by companies. But the payments are more usually made to employees, not to unions, and seldom by whole industries to single unions. In the Petrillo argument, a study was made of thirteen situations where employers made welfare payments directly to unions. But, the companies found, "none of them provide for the creation of a blanket unemployment fund for the benefit of people who have not and never can be employees of the parties making the contributions."

It is true that a nationwide 2 percent welfare payment agreement exists in the garment trades covered by the Amalgamated Clothing Workers headed by Sidney Hillman. But the $2,000,000 annual fund is jointly administered by the union and the employers. And it ought to be recognized that, no matter what its benefits to the employee, the fund has helped to reinforce the total strength of a big, tough, dictatorial union. The fact that the ACW is regarded by many employers as being highly responsible in its attitude toward the industry, is beside the point, because royalties would do just as much to strengthen some other union that had no sense of responsibility at all.

Realistic View of Issues Needed

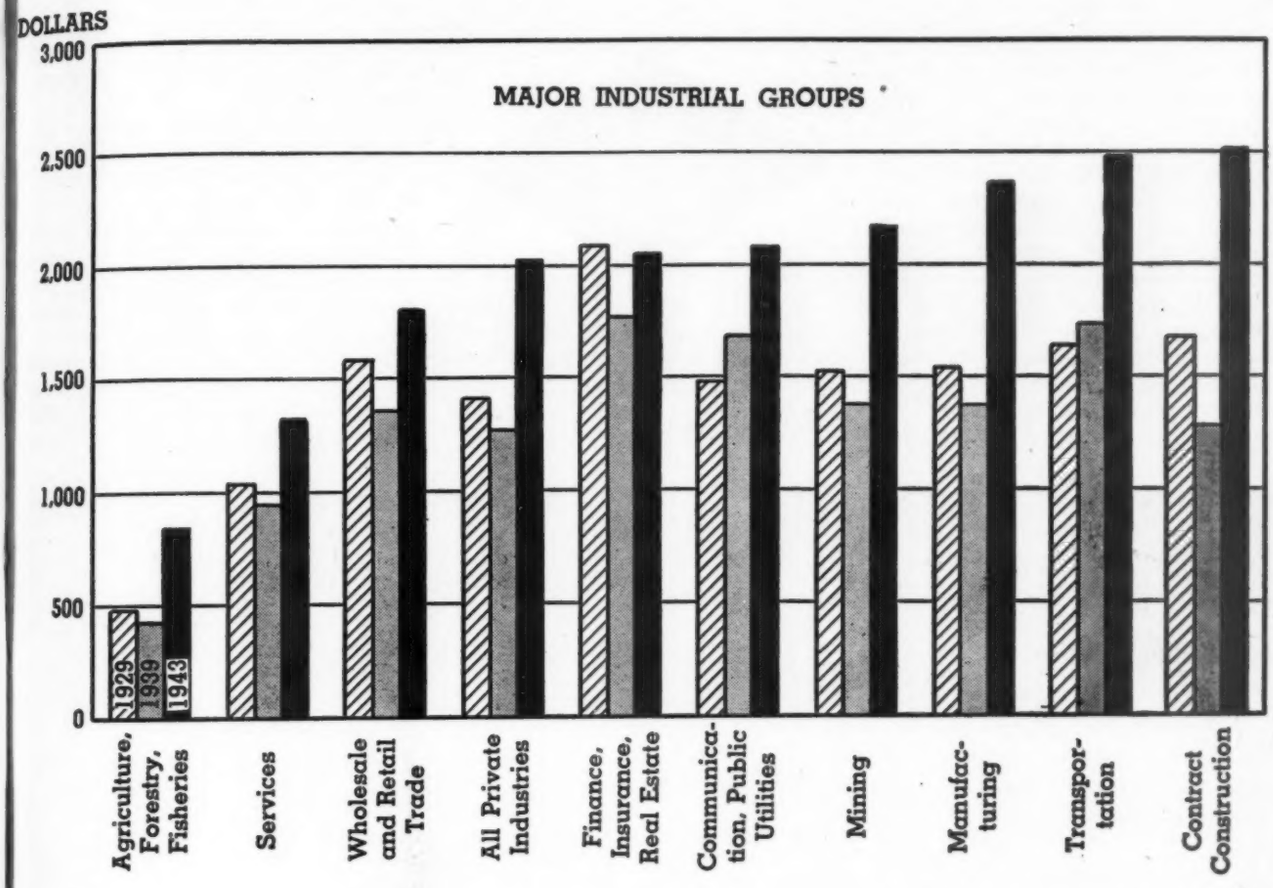
No sensible management man will quarrel with the principle of providing adequate health and old age protection to employees, nor should he object to contributing some part of his profits—preferably on a mutual basis—to this praiseworthy cause. Most employers will probably agree also that they have a responsibility in the financial readjustment of employees displaced by technological developments. Many excellent dismissal compensation plans exist in industry today.

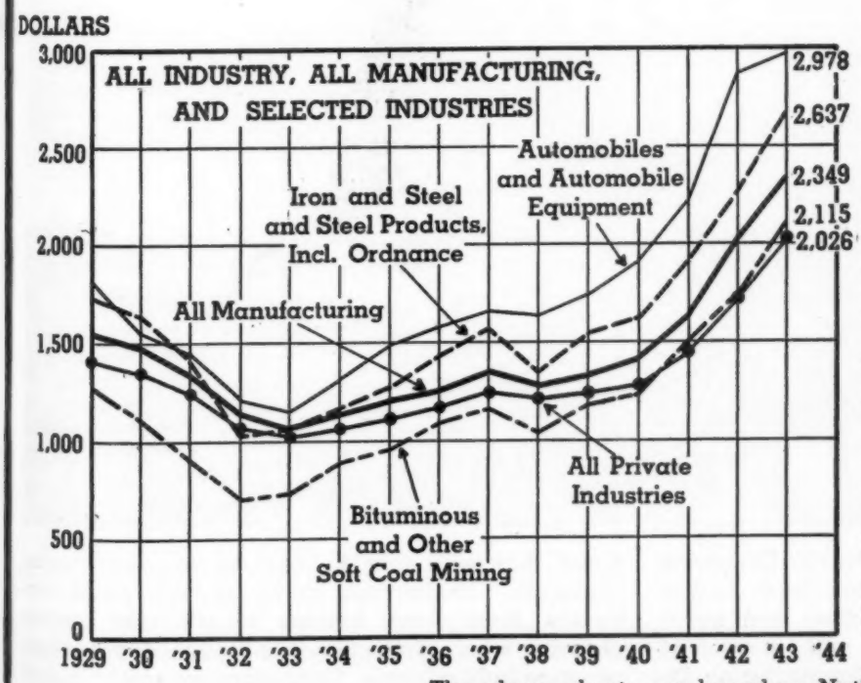
But that's a far cry from arbitrary fixed payments made at the gun point demand of unions to unions under conditions which inevitably aggrandize the union at the employer's (and sometimes the public's) expense.

If industry, government, and consumer are going to accept this type of agreement, they should do so only in a realistic recognition of its real meaning—which is sadly lacking today.

Annual Salaries and Wages

Per Full-Time Employee in Private Industry, 1929-1943*





ANNUAL COMPENSATION per full-time employee in manufacturing rose from $1086 to $2349, or 116 percent, during the decade 1933-1943. In the iron and steel industry, where labor demands for an annual wage are being pressed, the level increased from $1073 to $2637, or 146 percent. In the automobile industry the rise was from $1170 to $2978, or 155 percent; in bituminous coal mines, from $748 to $2115, or 183 percent.

In every major industrial group except finance, insurance, and real estate, the level of annual compensation was higher in 1943 than in 1933.

Source: U. S. Dept. of Commerce.

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* Total dollar amount paid out in wages and salaries divided by the number of "full-time equivalent employees"—i.e., actual full-time employees plus part time employees reduced to the equivalent number of full-time employees.

The above charts are based on National Industrial Conference Board figures, and are published in NICB's series, "Road Maps of Industry".

War Product Layout Sets Reconversion Pattern

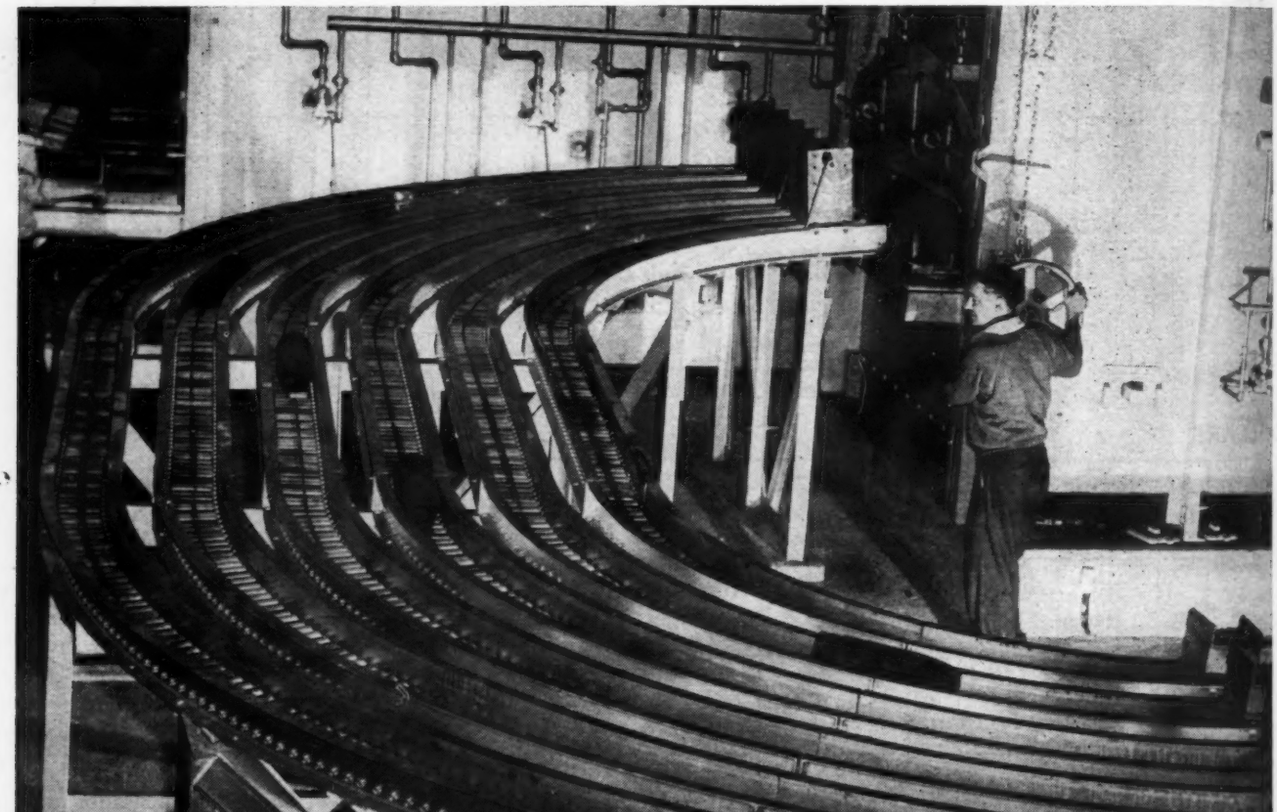
WAR PRODUCTION TECHNIQUES, tried and tested over the past four years, will provide the pattern for reconversion of Westinghouse Electric Corporation's facilities to the manufacture of civilian goods. Change-overs will be made with complete assurance that best use is being made of all the company know-how.

At Westinghouse, where it is a fundamental principle of management to place the responsibility for the operation of each plant directly in the hands of the plant manager, years of experience have developed the necessity

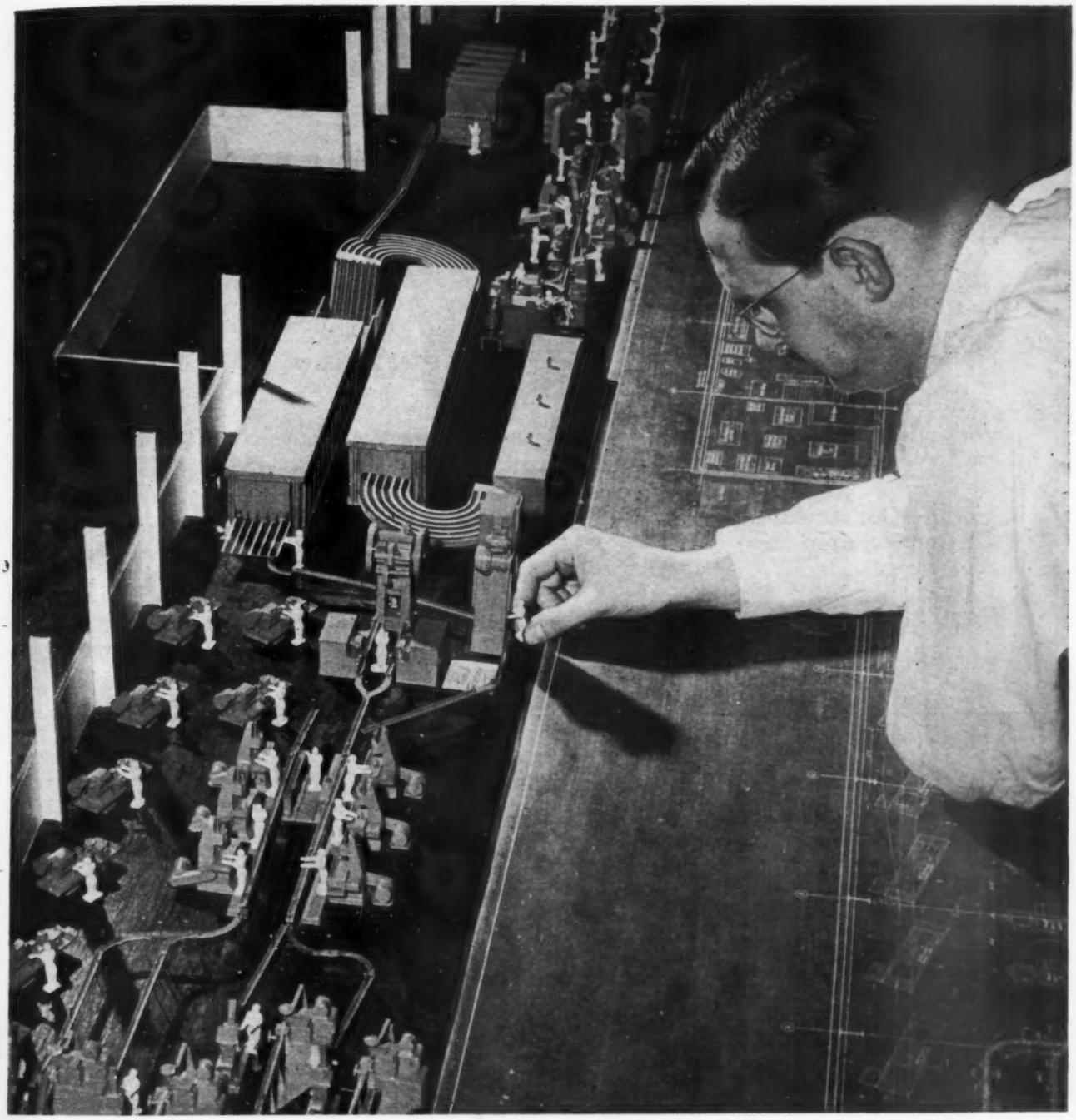
FOR LOW-COST PEACETIME PRODUCTS

for a central division to coordinate company-wide manufacturing problems, develop new manufacturing techniques and processes, and give assistance wherever it may be required in all phases of the plant manager's problems, including building and maintenance operations.

This central division, known as the Headquarters Manufacturing Division, thus becomes an important adjunct to the successful operation of a large company under the "unit manager" type of management. It has six departments (see page 100) which are prepared to service all Westinghouse plants with manufacturing information. If asked to do so, those groups are prepared to design and construct a new building, make recommendations for the tooling and materials handling



Rocket projectile line at Canton Naval Ordnance Plant was designed for straight-line flow, makes use of the best in materials handling and metal working methods. It was set up with the aid of the Westinghouse Headquarters Manufacturing Division, was selected to illustrate a war-born technique that will now be applied to reconversion problems. Photograph shows gravity roller conveyors from draw furnace to air mist cooling chamber where projectiles are brought to room temperature in 20 minutes. Conveyors are easily spotted on the scale model layout shown on the facing page



Maximum use of minimum space. Scale models of men, machines, and conveyors (¼ inch = 1 foot) made it possible to see that material arrives at and flows from work stations at the correct height for ease of handling—always important, but especially so when the product is a heavy one. Not only was the model line an aid to the plant engineering staff; it also helped Navy officials visualize the layout much better than they ever could have visualized it from two-dimensional templets. It is on jobs of this sort, where handling problems are complex and large money expenditures are involved, that the benefits derived from the use of three-dimensional layouts far more than offset their additional cost

equipment, make the plant layout, and coordinate the quality control system.

The division has at its disposal several laboratories in which various problems are studied. For example, the materials joining group will take a welding problem, ascertain the type of welding—whether resistance, torch, or arc—that will do the best job the most economically, and will even redesign the product for ease of manufacture if necessary. This group also has induction heating generators which are used to investigate the advantages of radio frequency heating and its applications to company products.

To illustrate how HMD functions, in September, 1944, the Navy asked the management of the Canton Naval Ordnance Plant to consider manufacturing rocket bodies. This plant had been manufacturing Naval Ordnance equipment consisting primarily of large work in relatively small quantities, involving the use of heavy machine tool equipment. It was the type of operation usually thought of as job-shop work.

A review of the problem indicated

Who Does What—Functions of Departments

Headquarters Manufacturing Division

Works Equipment ..... Engineering service on (1) equipment applications and specification; (2) equipment and contract records

Quality Control ..... (1) Quality control problems; (2) engineering research on inspection equipment and methods

Manufacturing Engineering ..... (1) Manufacturing methods and techniques; (2) most economical manufacturing tools, equipment, and operations; (3) plant layout and materials handling; (4) tool and expense materials standards

Production ..... Systems for inventory control, planning and scheduling, and all production activities; installation and operation of same

Building Construction and Maintenance ..... Design, construction, and maintenance of buildings and equipment

Wage Incentives ..... (1) Time study field engineering; (2) laboratory and standard time data; (3) time study training; (4) consulting service for wage incentive administration

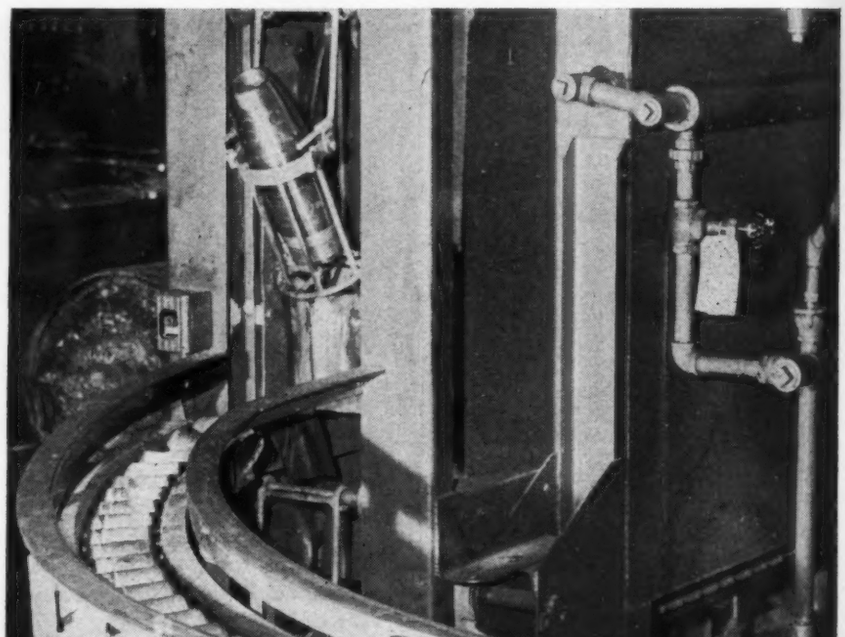
the desirability of removing all machine tools and equipment from one of the manufacturing aisles. This would provide 45,000 square feet of floor space and permit an ideal straight-line production layout starting with the forging brought in cars by rail to one end of the building and ending with the completed and packaged rocket bodies going into the railroad car at the other end.

Flexibility Needed

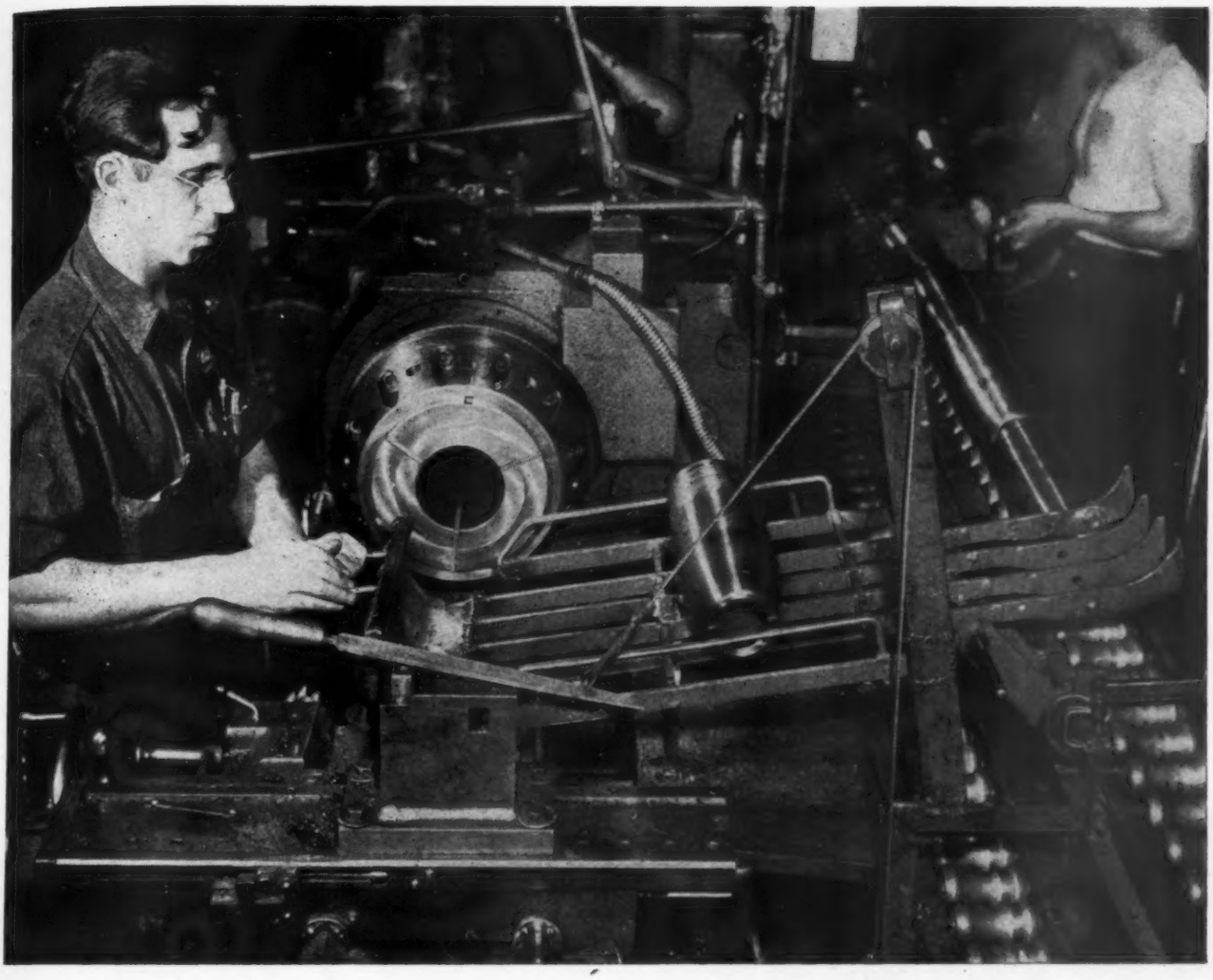
One of the stipulations of the project called for flexibility in equipment so conversion could be made to other types of projectiles if necessary. The other stipulation contained in the project was that of time of delivery.

The planning and methods engineers of the Canton Naval Ordnance Plant went to work, while the maintenance department started the job of clearing the entire floor space of all tools and equipment.

At this stage, the assistance of the HMD organization was requested. The HMD engineers—specialists in their respective fields—brought to the Canton Naval Ordnance Plant experience gained over a period of years in a wide variety of manufacturing problems. They were also in a position to contribute knowledge gained through their association from time to time with



Special attention was given to the materials handling problem; work moves from station to station with little handling by the operator. For instance, mechanical unloaders (above) remove projectiles from degreaser to roller conveyor which moves them to painting operation



Time required to handle projectile from conveyor to lathe was cut to 7 seconds (including chucking) by a special tray fabricated from light steel stock and counterbalanced for ease of manipulation

equipment and manufacturing engineers throughout the country.

First step in the process of developing the ultimate layout was to determine the operations required and the machine tools and equipment best fitted for doing each operation.

How Many Machines?

Next step was to estimate the time element of each operation which determined the number of machines of each type required to meet the monthly production. At this stage, a preliminary layout of the line was prepared and HMD equipment engineers prepared detail specifications of the equipment required, which permitted the purchasing department to place orders.

Tooling engineers prepared the design and specifications of tools and fixtures and gages so that procurement could be immediately initiated on these items.

Special care was given to the materials handling problem, and, as a result, work moves from station to station with little handling by the operators. No worker has to move the work more than 2 feet to and from his machine, either to get raw materials or to dispose of the finished job. Conveyors are all gravity operated, with powered belts at regular intervals to bring work to the men at waist or chest level; all are of standard design. The layout differs from most jobs in that each work station, consisting of one to six machines, is connected in sequence. This arrangement makes for increased efficiency and lower unit costs. "Hospital zones" or repair stations are spotted at several points along the lines to repair minor defects which may occur during manufacture.

The final layout of all machine tools, conveyors, heat-treating furnaces, etc., required careful planning and thought. The problem of handling the tons and tons of metal each day on a high production job of this kind has an important bearing on the production capacity of the line as well as the unit cost.

During the time that tools and equipment were being designed and procured, many hours were spent in arriving at the most efficient layout. To facilitate this study, a three-dimensional layout was prepared. This permitted a minute study of every movement of the rocket shell from the first operation to the last. But even after the project was completed HMD was called upon to supply aid during the initial production stages.

From Start to Finish

In short, it followed the job from start to finish. And in times like these, when manufacturing techniques are in a constant stage of improvement, and with reconversion no longer around the corner but actually here, the division is preparing to offer the same sort of service to other plants and thus help speed the flow of peacetime goods in the critical period ahead.

Better Workplaces Mean More Output, Lower Cost

E. W. ZABRISKIE, Methods Supervisor, Friez Instrument Division, Bendix Aviation Corporation, Baltimore

A TECHNIQUE FOR PEACETIME PRODUCTION

MUCH HAS BEEN SAID and written about proper utilization of time values, economy of motions, and improved methods as ways to cut costs—but comparatively little about workplace analysis. Yet this latter approach to low unit costs, as used at the Friez Instrument Division, has been found just as important as any.

After time studies are taken and time values utilized to determine the elements of the operation, the workplace becomes a primary consideration. If proper attention is given this work area, including storage bins and tools, the operator is 100 percent ready to produce; there is a minimum transportation for each part; parts are easily accessible to each hand.

If the operation is part of a straight-line unit, the "from" and "to" factors are first analyzed. Where does the assembly come from? Conveyor, chute, slide? Or is it simply hand moved along the workbench? Where does the assembly go? To a conveyor, chute, slide? Is the assembly fragile, bulky, or heavy? How can it best be handled in a minimum of time? How can the assembly best be moved? By conveyor, chute, slide, totebox, rolls? (See Figures 1 and 2).

How many parts are assembled at the work station? Can they be stored individually? How do they come to the operation? By totebox, special racks, or in bulk from stockroom? What are the sliding qualities of parts? Are they metallic, rubber, plastic? This determines at what angle material storage bin bottoms must be built in order to gravity-slide parts (Figure 3) to the operator.

The standard amount of bench space per operator is usually 36 inches long by 30 inches deep. How much bench room is needed for tools and fixtures? For the assembly? The remaining space may then be used for parts storage, and the greater the extent to which this space is utilized, the more the number of replenishments of parts can be decreased.

Be sure that there is plenty of knee room and light for operator. Approximately 30 foot-candles of light is enough for most assembly work. The standard height is 36 inches.

Provide drop discharge chutes (Figure 4) for scrap or faulty parts to be collected in scrap box; from there it may be easily counted and itemized.

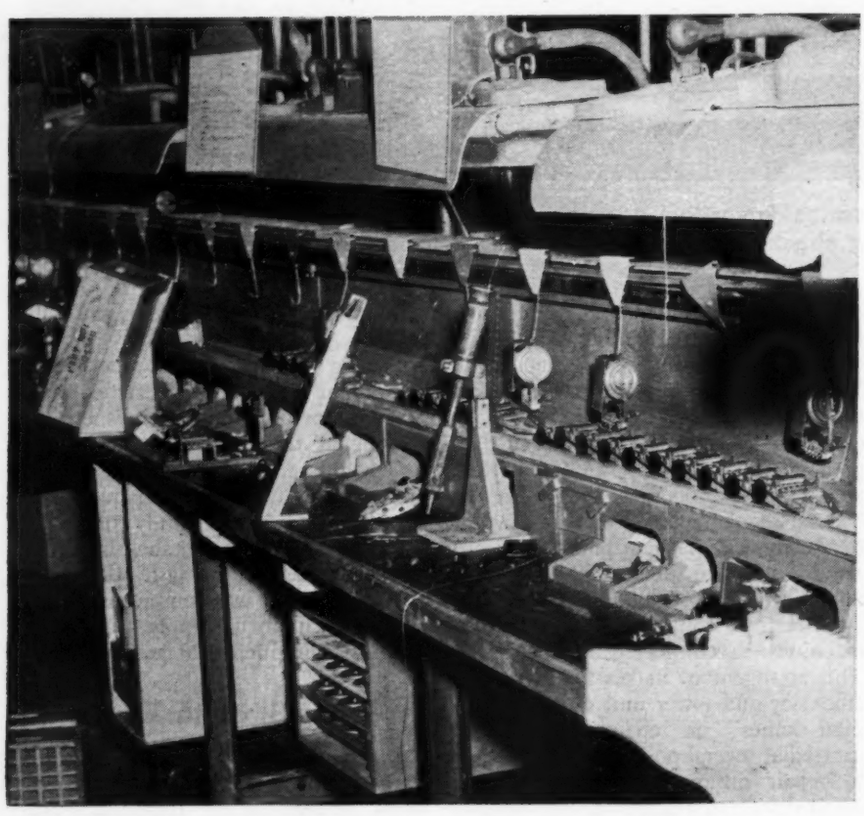


Figure 1. Subassembly line with conveyor to move parts to subsequent point of use on final assemblies. Note track to move partial assemblies from one operation to the next. Note also assembly fixtures on bench including stationary adjustable solder iron. Totebox holders on top and beneath workbench make subassemblies quickly available. Operation card holders are hung from fluorescent fixtures

Material Storage Bins

Now that it is known what space is available on the workbench for storage, the problem remains to allot this space to store as many of each part as can be taken care of. In addition, determine which parts are handled by each hand and locate these parts nearest this hand. Plan to keep both the operator's hands busy a maximum amount of the time.

Each compartment of storage bin

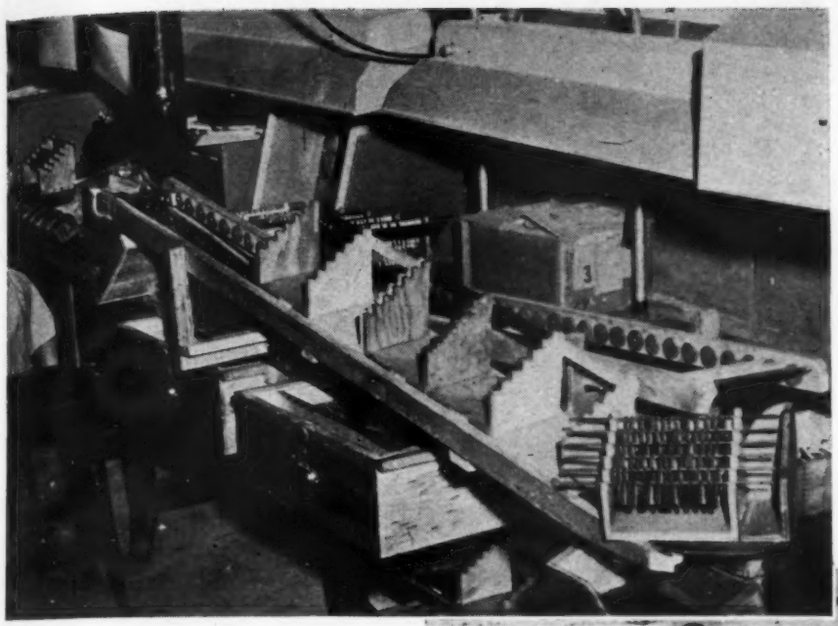


Figure 2. Parts are formed to "V" on rods. The loaded rods are placed on step racks. Loaded step racks roll down gravity conveyor at rear to next operation at far left. Empty step racks and rods return on front conveyor for re-use. Rollers for conveyors are made by cutting circular disks out of pressed wood or plywood with a hole saw. After being waxed, disks roll easily and freely.

Figure 3. Note quick-opening material bottle suspended in tilting cradle so that silica gel in bottle may be easily emptied into trough. Different parts (caps and corks) are arranged to keep both hands occupied. Angle of slides inside material rack keeps a good supply of parts at front of compartment available for assembly. Assemblies to be stored are drop-delivered to storage bottle under bench at lower left. Assemblies for immediate use are delivered to next operation by slide at right

Figure 4. Bench-type belt sanders are properly guarded and have "on" and "off" switch in convenient location. Chute at edge of bench carries scrap to scrap boxes on floor. Material racks hold over one day's supply of parts and tilt tote boxes at convenient angle to receive parts. Assembly fixture enables operator to sand part at proper angle

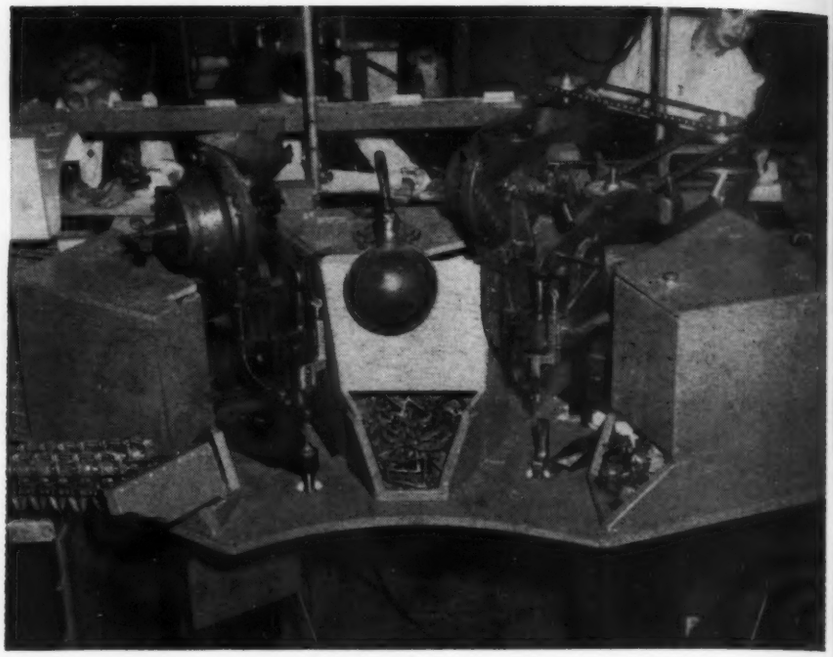


Figure 5. Workplace with special set-up to enable one operator to use two riveting machines with a minimum of lost motion. Parts from center and right-hand material rack are riveted on machine at right while parts in left-hand material rack are riveted to assembly on machine at left. Completed assemblies are dropped to gravity slide at lower left

holds, if possible, a minimum of half a day's parts, preferably a full day's parts. If dust and dirt are a factor, cover storage bin with hinged cover that will open easily. Be sure that maximum allowance is made for replenishing parts by stockman.

Plan 45-deg. lips at each compartment opening to prevent parts from mixing with other parts on bench. Make sure that bottom of each compartment is at proper angle to keep parts sliding to lip of compartment as parts are removed. If some parts or subassemblies come to the workplace in toteboxes or special racks, design storage bin to accommodate a number of these loaded boxes as well as a place to put empty toteboxes where they may be conveniently removed.

Further, make provision to hold the totebox, from which the operator is working, at the most feasible angle for part removal. Space underneath the workbench (Figure 1) can be utilized to hold empty and loaded toteboxes to enable the operator to reach them easily without leaving the workplace.

When machines are used, design material racks (Figure 5) to suit contours of machine and size and shape of parts used.

An added improvement (Figure 6) is to place small cards, with the part name and number typed on, in metal holders on outside of each compartment. An operation card holder containing operation sheet should be located at each workplace.

Figure 6. Assemblies move along inclined track on bench in progressive assembly. Inclination of track enables operators to see into assembly without bending over. Material racks hold variety of parts. Roller conveyor delivers partial assemblies to next operator. Part name and number are posted on little white cards on each compartment of material rack. Drop chute carries scrap to scrap box under workbench. Shelves in front of material rack at right are used for temporary storage of partial assemblies

Bench Construction

Good workbenches are made with 2-in. pine tops covered with $\frac{1}{4}$-in. pressed wood, and equipped with metal legs, modesty board, and footrest. Benches range from 6 to 12 feet in length, are 36 inches high and 30 inches wide. A $\frac{3}{8}$-in. molding around the outside edges hides pressed wood and pine top junction.

Storage bins are made of $\frac{1}{4}$-in. to $\frac{1}{2}$-in. plywood, using pressed wood, and sometimes laminated plastic, for bottom of compartments.

Standard adjustable chairs with back rest are used with these workbenches. Lighting is secured by fluorescent equipment hung approximately 18 inches from top of bench. This distance varies with size of parts and fineness of adjustment necessary.

In this company's experience, proper workplace layout, correctly analyzed and executed, increases operator efficiency, aids parts handling, makes supervision easier, improves plant appearance, and raises morale considerably. This attack on costs is directly reflected in increased production at substantially lower cost per unit of manufacture.

Welcoming Veterans Back to Work

HERMANN H. STRACHAUER, Chief, Veterans' Advisory Section, Minneapolis-Moline Power Implement Company, Minneapolis

A RECONVERSION PROBLEM

INDUSTRY HAS A NEW DUTY to perform. It is that of welcoming and reemploying its personnel now on military leave. With a special division set up to handle returning servicemen, Minneapolis-Moline feels that it is equal to the job.

The company confronts this problem fully aware of the many difficulties the returned serviceman faces in readjustment to the routine of daily living. The statement in the opening paragraph is not intended to convey the impression that the company knows all the answers, or that all phases of this program will operate without a hitch. Changes will naturally take place as new situations arise.

MM's experience indicated that in many respects the ordinary employment procedure is not entirely satisfactory for the re-induction of ex-servicemen. For this reason, it decided to adopt a re-induction program which, while uniform in its principles, was sufficiently flexible for adaptation, within broad limits, to the varied problems of individual ex-servicemen.

Veterans' Section

This program is administered by a new division, the Veterans' Advisory Section, which has been especially created for the purpose as part of the industrial relations division. This section is headed by a man whose military service as a regimental staff officer and broad contacts with the problems of men and women in the armed forces gives him the background necessary for a position of this kind.

As a staff member, the chief of the Veterans' Advisory Section does no actual hiring as such. Rather it is his task (1) to formulate policies and procedures governing the reemployment of veterans; (2) to keep abreast of legal developments affecting the employment of veterans; (3) to disseminate pertinent information to management; (4) to train, advise, and assist personnel and employment managers and other members of the supervisory staff in their handling of veterans' problems; and (5) to find solutions to some of the vexing problems that inevitably arise. He is responsible to the director of industrial relations, who in turn answers directly to the president of the company.

In general, the policies and procedures formulated by the Veterans' Advistory Section grant benefits and privileges over and above those conferred by statute. Such extended benefits and privileges are granted as a matter of company policy and not as a matter of right, and are, of course, subject to modification or termination at the company's discretion. MM intends to keep well within the provisions of the Selective Service Act and the GI Bill of Rights.

To date over 300 veterans have been hired, of whom approximately

STEP 1. Local personnel manager at one of the Minneapolis-Moline plants welcomes a returned veteran who has come to see about getting his old job back. In the strictly informal interview that ensues, the company's veteran policy and reemployment program are explained

STEP 2. Interview with personnel manager shows MM veteran eligible for, and desirous of, immediate reemployment. He is therefore introduced to the employment manager for processing, then escorted to the medical department for examination. In background, another returned veteran awaits his turn

one-sixth were employed by the company at the time of their induction into military service. The average age of the 1608 MM employees in military service is 28.2 years.

Let us look at the standard procedure followed in all MM plants in reemployment of World War II veterans. (Except for minor mechanical differences, employment of veterans not former employees is accomplished by the employment managers and the hospital staffs in the same manner as employment of non-veterans.)

To begin with, whenever any MM veteran, who is out of the armed forces or ready to leave the armed forces, visits or otherwise gets in touch with any supervisor or other member of MM management, that supervisor without delay refers the veteran to the local personnel manager. This referral is standard procedure whether the veteran is inquiring about ways of getting back his old job, whether he shows any interest in his post-war job, and even if he is only visiting.

The personnel manager then extends an appropriate welcome and conducts an *informal* interview. This interview, during which the MM veteran policy and program are explained, may be between the personnel manager and the veteran only, or it may be among several employees, and may even include a chat with the president of the company or some other top executive.

Concerning employment policies:

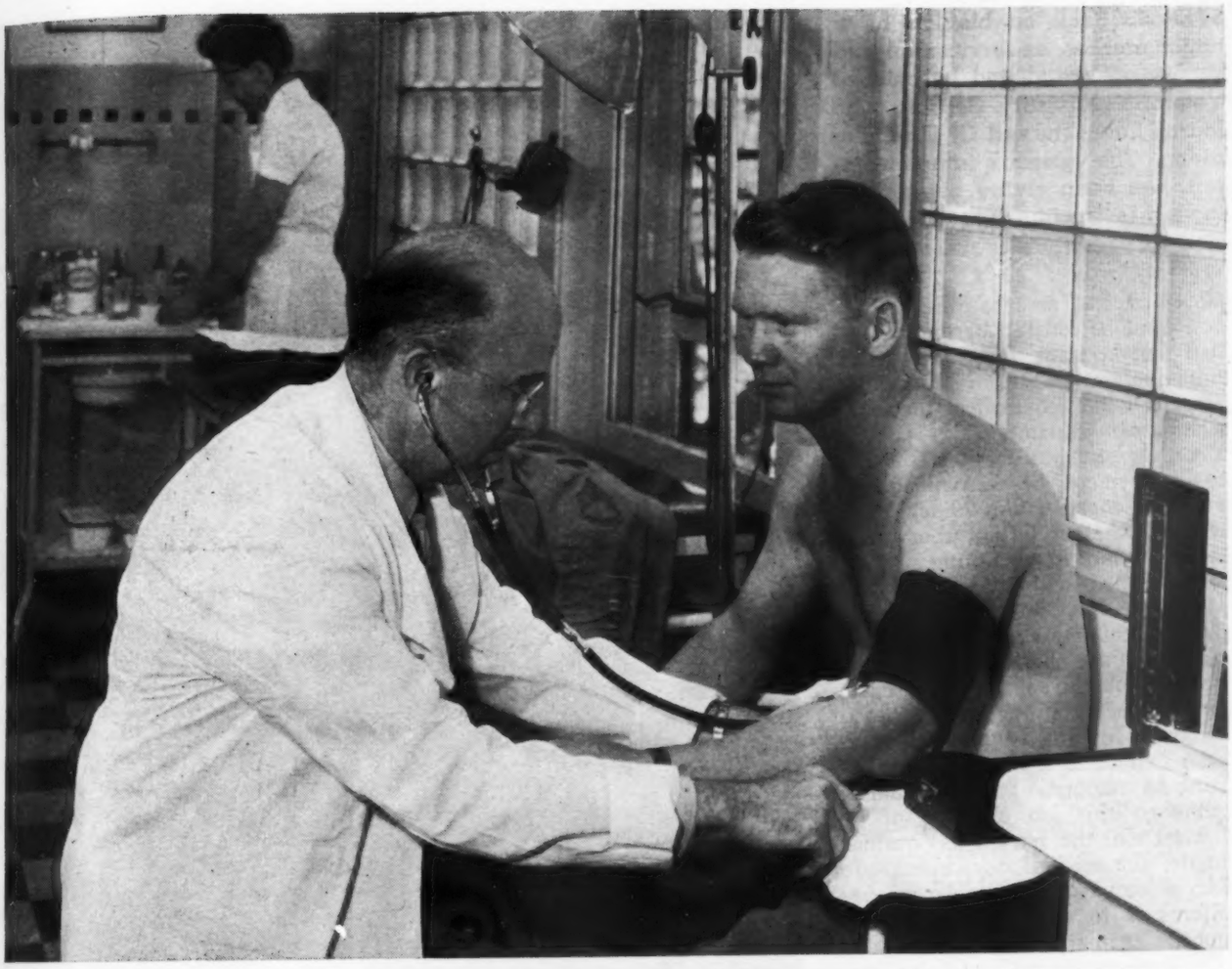
1. MM veterans are considered not only in respect to general acceptability but also in respect to what they might be best qualified to do physically and mentally in regard to any and all job classifications in the company.

2. MM veterans who have a service-connected percentage of physical or vocational disability are given special consideration as to what type of employment they might be capable of performing or what types of jobs they might be best trained to do.

3. If the MM veteran indicates his intention to return to his old job but does not wish to report for work immediately, the personnel manager points out reemployment conditions and sets a date when the veteran will report for reemployment processing. Within the discretion of the personnel manager, a veteran may be granted an additional 30 to 60 days beyond the statute limitation of 90 days, in which to report.

4. If the MM veteran is eligible for and desires immediate employment, he is introduced to the employment manager for processing and then escorted to the medical department for examination.

In the latter instance the hospital staff is notified in advance by the personnel office of the veteran's status as a former company employee. In addition to having hospital or first aid stations with nurses on full-time duty at every installation, MM has a



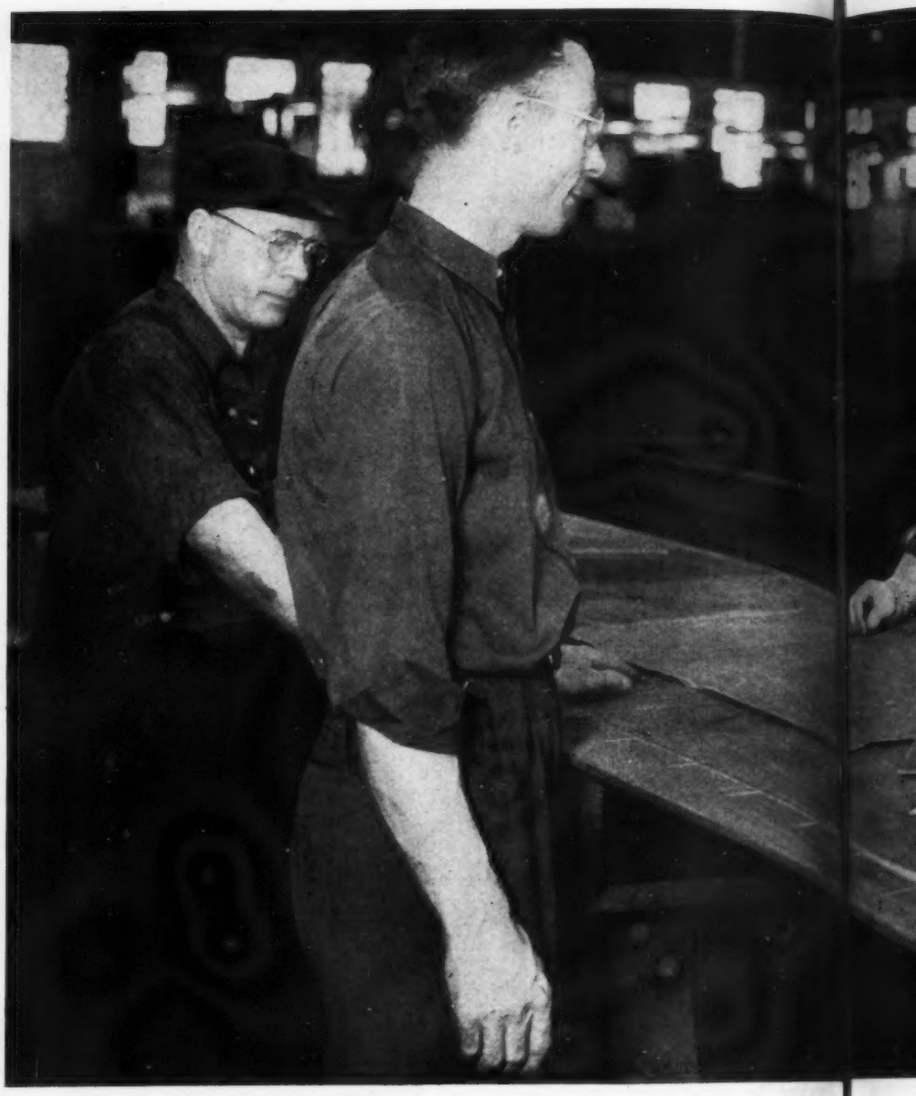
STEP 3. Veteran or non-veteran, every MM employee is given a complete medical examination prior to employment. Every reemployed veteran is reexamined as a matter of course within 90 days to determine whether or not the job selected is aggravating any service-connected disability

STEP 4 (right). Reemployed veteran is introduced to supervisor by member of personnel department. Note safety goggles, an MM requirement for all

staff of physicians under the supervision of the company's medical director. These physicians have regular hours at each installation and are subject to call at any time. After examination, the veteran is returned to the personnel manager.

Every MM employee, whether veteran or non-veteran, receives a complete medical examination prior to employment. In addition, each em-

STEP 5. Back on his job as a junior marker, ex-serviceman and supervisor are visited by chief of Veterans' Advisory Section, who learns how returned GI is getting along. The veteran's father, at far left, has been giving his son on-the-job instruction



ployee after an absence caused by illness must be certified by the hospital staff that he is fit to return to work. An important feature of the medical program is the requirement that every reemployed veteran, besides receiving a complete medical examination prior to employment, be *reexamined as a matter of course within 90 days* to determine whether or not the job selected for him is aggravating any service-connected disability.

At the discretion of the medical director, this reexamination may take place within a shorter space of time. For example, a veteran with a leg injury contracted during military service was assigned, after a thorough medical examination, to a 10-man crew operating an automatic printing machine. Although this job was one of the lightest that the veteran was qualified to do, the medical department gave him a second check-up only two days afterwards to determine whether or not the leg injury was being aggravated.

Whenever the medical department questions the reemployability of a veteran, a second examination by the company's medical director is arranged for by the local personnel manager. If, after the second examination, the medical department believes that reemployment at the present time would not be to the best interests of the veteran and the company, the local personnel manager refers the case to the chief of the Veterans' Advisory Section for final review and disposition. The latter receives a complete and confidential report from the medical department covering the findings and reasons for rejection.

Medical Report Discussed

The chief of the Veterans' Advisory Section, with the findings and recommendations of the medical department before him, holds an informal conference with the veteran. The purpose of this conference is to present the findings and recommendations of the medical department to the veteran and to discuss his plans in light of what the medical examination has disclosed. If reemployment appears inadvisable, the chief of the section explores every avenue of assistance for the veteran. He may, for instance, get in touch with local representatives of the Veterans' Administration for the purpose of assisting the veteran in obtaining needed medical service, or discuss the case with the State Department of Veterans' Affairs.

If a veteran is passed for reemployment by the medical department, the personnel manager, who functions in the capacity of local veterans' advisor, completes with the employment manager the details of reemployment. Members of the personnel staff then explain company policies and changes to the veteran, inform him regarding safety rules, company benefits, etc., and introduce him to his supervisor.

During the veteran's second day on the job the personnel manager visits with him and his supervisor to determine how well he is getting along. At the end of the second week the supervisor reports on the veteran's progress to the personnel manager. If circumstances warrant, re-analysis, reassignment, or retraining may be advisable.

Eventually the chief of the Veterans' Advisory Section visits every reemployed veteran while at work to learn how he is getting along. All separations of MM veterans are subject to a complete physical examination. And no veteran can be discharged for cause without a complete review of the case and the approval of the chief operating executive.

By means of demonstration and lecture meetings, foremen and supervisors have been led to appreciate the readjustment problems of the ex-serviceman. (Group conferences are also held every two weeks for management personnel, during which problems of industrial relations are thoroughly discussed.) MM management believes that in certain cases a year may not be too long an orientation period for a discharged serviceman. Foremen and supervisors are therefore urged to keep in mind what a disabled veteran has to offer, not what he is unable to do.

So much for the mechanics of the

program for reemploying veterans. Like most companies, MM has as yet had only a limited experience in placing veterans seriously disabled from an occupational standpoint. But the company looks confidently ahead to the problem, believing that it will find a satisfactory solution to each situation. Underlying every phase of its program is the desire of management to afford every opportunity to the veteran which will help him realize himself as an individual. This implies a personal interest on the part of management in each veteran's welfare going beyond that of a mere business relationship.

By means of its department of public relations, the company has managed to keep in frequent touch with its employees in military service, printing their photographs and letters in the house organ, sending occasional gifts such as decks of playing cards and cartons of cigarettes. To the family of each employee who enters military service goes a bronze plaque with the name of the employee engraved on it. Furthermore, every employee normally entitled to vacation pay, had he not been called to military duty, receives that pay upon his induction. In addition, if an employee has 52 weeks' aggregate company service behind him, he is given one month's pay.

The veteran, like all employees at MM plants, is at liberty to drop in and talk things over and get advice on personal problems from members of the personnel staff. This organization is ready at all times to provide assistance to the veteran on matters pertaining to such problems as insurance and federal benefits, and to act in an advisory capacity in his dealings with established veterans' agencies.

In the belief that many veterans need a period of orientation after donning civilian clothes, the company through the local personnel manager will often recommend to a veteran who indicates an intention to take a course of study under the GI Bill of Rights, that he take his old job for three months or so, during which time he will have the opportunity of thoroughly threshing out his future plans. By working at his pre-war job, even if for three months only, the veteran acclimates himself to an environment that was familiar during peacetime. After such a period he may decide to take the course of study decided upon earlier or to take an entirely new course of study, and if he does, he will do so more firmly convinced of being on the right track than he would have been had he not re-familiarized himself with pre-war surroundings.

Individual Treatment

Such recommendations on the part of management follow no cut-and-dried rules. They are based on sincere interest in the welfare of each veteran, and vary with the individual and his circumstances. The important thing kept in mind is that veterans returning to civilian routine are facing a tremendous readjustment, especially so in the case of ex-servicemen who have had several years' military experience overseas.

On the whole this program is working out well. Supervisors go out of their way in their efforts to help a veteran adjust himself. That attitude prevails among all managerial employees. MM management believes that the essential point to bear in mind in reemploying veterans is that the vast majority of ex-servicemen—handicapped or not—do not want or expect favoritism. What they want is a chance to do an efficient day's work and to receive a fair return in the job for which they are best qualified.

Everyone in industry, from top management to newest worker, should know this insigne. It's the Honorable Service Emblem awarded to war veterans

Teaming Conveyors for Steady Flow of Product

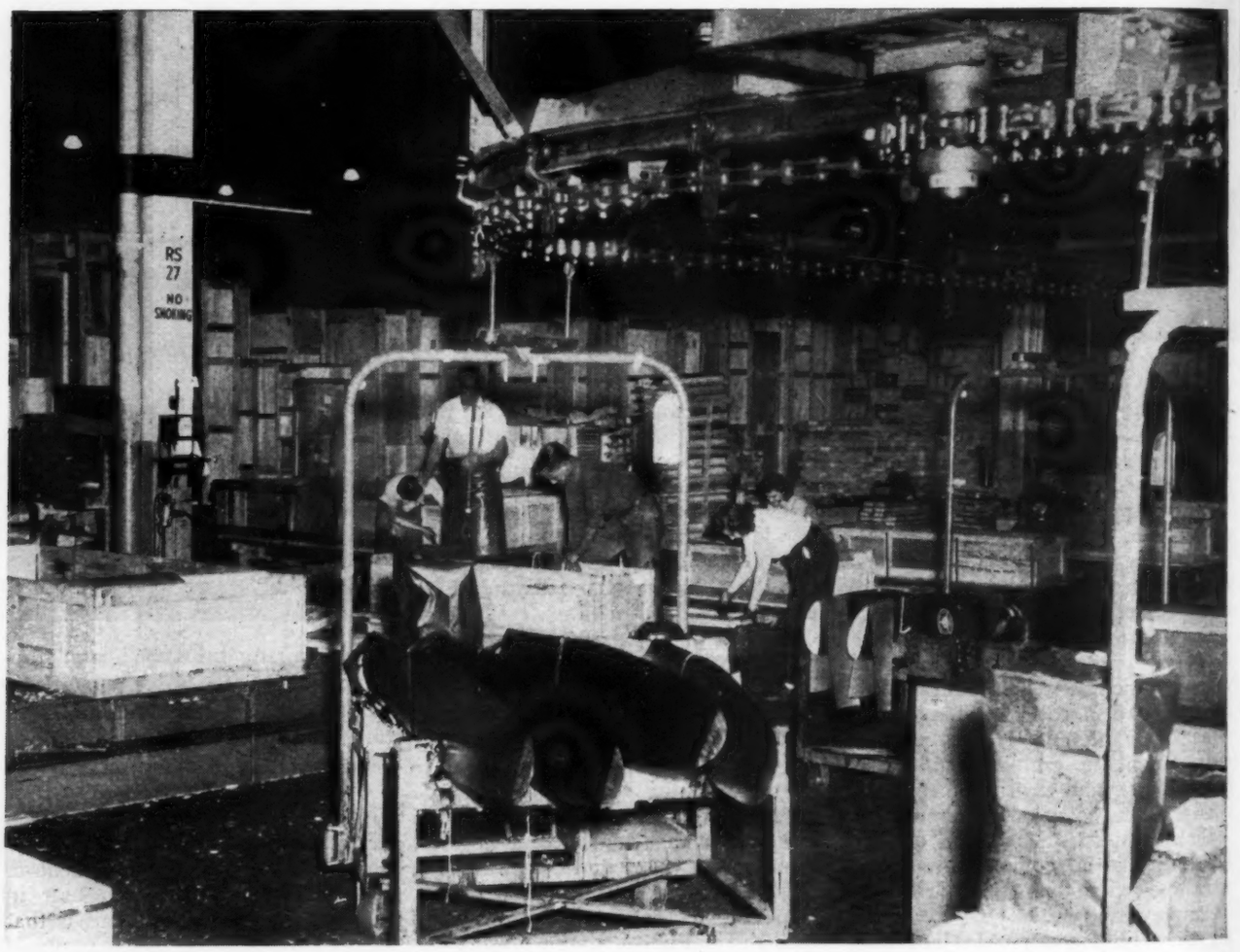
JOSEPH F. O'BRIEN, Supervisor, Shipping and Traffic, Indianapolis Plant, Curtiss-Wright Corporation, Propeller Division

INTERRUPTION OF THE STEADY FLOW of output, too often exemplified in temporary product storage at the entrance to the shipping room, is conspicuous for its absence at the Indianapolis plant of Curtiss-Wright Corporation's Propeller Division. Here, in place of time-honored stop-and-go methods, one finds direct transfer into waiting boxes which are moved immediately through ensuing operations on a slat conveyor known to people in the plant as the "Big Link."

"Waiting" is a key word in the statement just made. More about it later. First it should be noted that finished propellers have been balanced on the final assembly line, are then disassembled, placed in square-framed trolley cars equipped with casters, and "walked" to the transfer point. Each of the four blades is fitted into a special rack in the car, and component parts —hub, power unit, and attachments —are carried along in a separate compartment.

As the trolley conveyor moves along, the blades and outside surfaces of all parts are treated with a heavy protective compound applied with a paintbrush, and bearings are wrapped in heavy moisture-resistant paper.

At the transfer point, where trolley-



Where trolley-type and slat conveyor meet, at Indianapolis plant of Curtiss-Wright Propeller Division. Propeller has been balanced and disassembled, each of the four blades fitting into a special rack of the trolley car. Component parts—hub, power unit, and attachments—are carried in a separate compartment. At transfer point, blades are moved one at a time via hoist and placed in shipping box

Slat conveyor, called "Big Link," is 185 feet long, consists of three 18-in. tracks with walkways between them, is manned by 14 people. Tracks move at rate of 3½ feet per minute. Left, box assembly

type and slat conveyors meet, units are picked up by an overhead hoist, which handles one blade at a time, and deposited in the waiting box on the slat conveyor.

This conveyor is 185 feet long and 8 feet wide, consisting of three 18-in. tracks with walkways between them. Slats are made of hardwood, 8 inches thick, forming a belt which is driven by a 6-hp. motor mounted in a pit beneath the floor. The conveyor can handle 15 propellers per hour, moving at a rate of 3½ feet per minute.

Fourteen employees check the blades and parts in their boxes, join the boxes together, reinforce them for shipment, and finally ease them onto a gravity conveyor which carries them to the box car ramp.

The Indianapolis plant carries a stock of 1800 to 2000 knock-down boxes stacked near the conveyor. Box parts are coded for accurate selection since close to 500 different-sized boxes are currently in use. And that brings up the keyword, "waiting." Boxes must of course be ready when the propellers arrive at the transfer point. Any old box won't do. It must be the box specially designed for the particular propeller or group of parts arriving at that particular moment. This important detail is handled by means of a four-station telautograph system which speeds boxing and shipping information to vital positions along the line.

When blades are placed on the trolley conveyor, the following information is written immediately on the machine at the first station: Blade serial number, power unit and hub serial numbers, sales order number, and whether the unit is for domestic or foreign shipment.

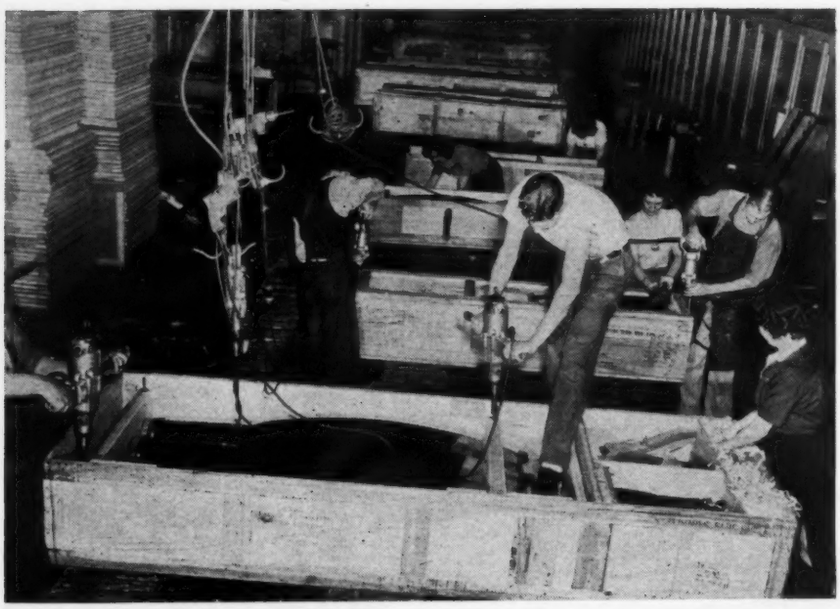
All Stations Get Data

This information is carried to the other three stations: (1) Shipping inspection, when the power unit and all attachment assemblies are made ready to be placed along with the hubs and blades on the trolley conveyor; (2) shipping inspection office, where the information is transcribed on the Army's historical record sheet; (3) head of slat conveyor. Employees at the latter station then know from the sales order number what boxes are needed for units moving along the trolley conveyor. The boxes are therefore assembled and waiting when the units are transferred from the trolley cars.

Each box, made of strong plywood and stamped with water-resistant ink, holds either three or four spare blades for shipment to field service bases, or a complete propeller ready for installation on a modern warplane. Boxes are carefully engineered to withstand heavy shocks and carry braces as well as steel bands strapped around each continuous row of cleats.

When a two-man crew completes the assembly of a box, it is moved to the beginning of the slat conveyor where, crosswise, it starts its 185-ft. trip down the shipping room floor.

At the first station, blades, hub, power unit, and attachments are placed in the box. Blades are held by heavily padded braces designed to avoid scratching. The power unit is mounted on a special base built into the box and then bolted down. There is no



Left, power tools not only speed up assembly operations, but make the job easier. At this point, boxes are almost ready for their lids. Each blade rests in cradle to prevent its moving around. Note separate compartments for hub, power unit, and other parts

Crate (middle photograph) rides crosswise, resting on the three moving tracks of the slat conveyor. Steel strapping is fastened by special hand tools to continuous cleats to strengthen the unit

Propeller, now boxed and ready for shipment, is up-ended (bottom photograph) and placed on gravity roller conveyor, positioned at right angles to slat conveyor. A "stop" then halts box at a point where it is carried via fork truck to waiting box car or storage

possibility of sliding or rattling within the box.

An inspector checks to make sure all parts are bolted and braced, and then the lid is nailed on. Nails have replaced screws to ease the unpacking job of base mechanics and ground crewmen at far-off bases and at factories and modification centers.

With the lid securely nailed, the entire unit is bound by steel straps which are clinched and tightened by a special hand tool. Straps are placed only where the cleats form a continuous solid surface around the box.

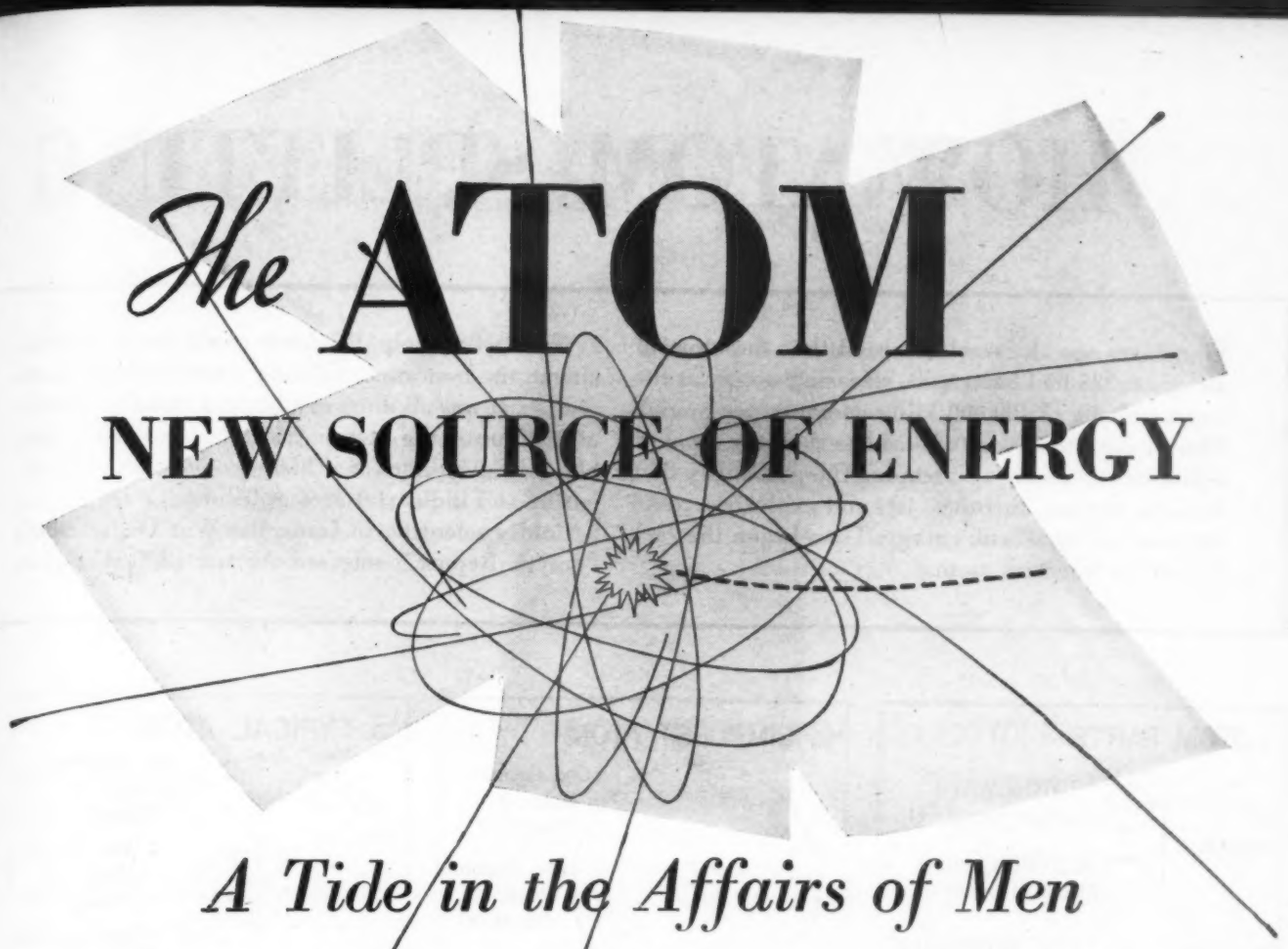
All these operations are performed on the move. Photographs show how operators work from the walkways or ride the tracks if necessary. Power tools speed up many of the operations.

Trip Up-Ends Box

At the end of the slat conveyor the box passes over an automatic tripping device. Fork-like legs then swing up underneath and up-end the box on its side onto a gravity conveyor several feet higher than the slat conveyor and running at right angles to it. On this latter conveyor, the box hits another trip which causes the up-ender to lower back into position to handle the next box. A "stop" then halts the box as it moves along the gravity conveyor.

At this point the crated propeller is ready either to be loaded into a waiting box car a few feet away or to be carried to storage. Both moves are made either by fork-lift trucks or by overhead bridge crane.

The ATOM
NEW SOURCE OF ENERGY



A Tide in the Affairs of Men

On August 6, 1945, an atomic bomb exploded over the Japanese city, Hiroshima.

Its concussion blasted the city, vaporized the fibre of Japan's will to resist, and flashed across the world a light of such glaring intensity that even blind eyes could glimpse the forked road that is presented to humanity's choice and destiny.

It has been a scant fifty years since Pierre and Marie Curie embarked upon their research with the avowed intent of discovering "how the atoms of the universe are put together". Their work contributed radium to the knowledge and use of mankind, but it marked only a way station upon the awesome quest which they announced and which thousands of scientists have since pursued.

Under the compelling stimulus of war, the first major application of the release of atomic force has been in an instrument that raises by an unimaginable dimension our ability to dole out death. We can be devoutly grateful that the scientific leadership of the Allies, and particularly the industrial strength of the United States, brought to us, rather than to our enemies, priority in the development of this dread weapon. But even in its present infant phase, it is clear that ownership of the principle of the atomic bomb carries a trusteeship of terrifying gravity.

We hold in trust a power that is capable of unraveling the very fabric of our civilization. Equally, it may be susceptible of development as a mighty force for human welfare. But we have proved the destructive use, while the constructive applications are still in the realm of speculation.

Clearly the trust is of a magnitude that transcends national jurisdiction. No walls have ever been built high enough to fence in the spread of scientific knowledge, and even if we were resolved to forego the harnessing of atomic power for peace, it is hopeless to think that its application for war can be held for long as the monopoly of one, or a small group of nations.

At one giant stride our scientific and technological development has so far outdistanced our social engineering, that we have no choice but to turn our full powers of creative imagination to control the forces we have unleashed and to bend them to man's use rather than to his destruction.

Since control is not possible without understanding, I have asked several of my editorial colleagues in the McGraw-Hill organization to present on the pages which follow a non-technical but authoritative account of the known facts and implications of atomic power.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

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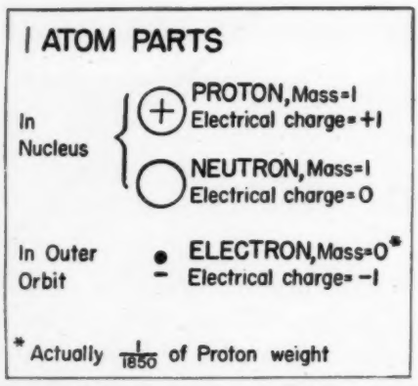
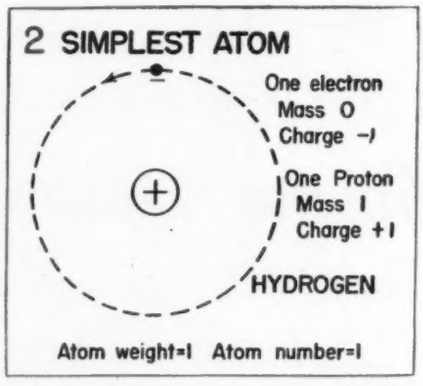
HOW ATOM SPLITTING

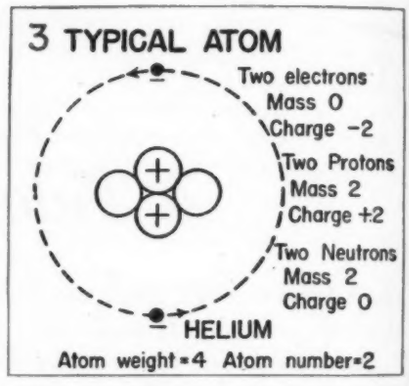
Five years ago the world learned that the atom of Uranium 235 had been split, releasing energy at the rate of about 11,400,000 kilowatt-hours per pound. The whole amount tested was less than the head of a pin, but there was no escaping the possibility that heaters, engines, turbines, jets and explosives could be powered by atomic energy. Then began the race to win the war with atoms.

With what help England could give, America outran the best atom-splitting team Germany could muster. It was all done in silence. From the summer of 1940 until the atomic bomb blasted Hiroshima, black secrecy blanketed history's most amazing scientific and industrial accomplishment.

Coldly scientific in form, the War Department's "Smyth Report," released August 12, 1945, traces

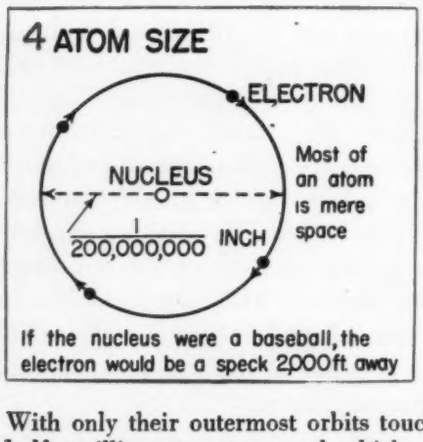


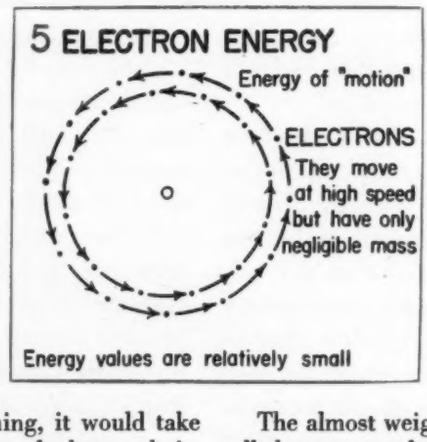


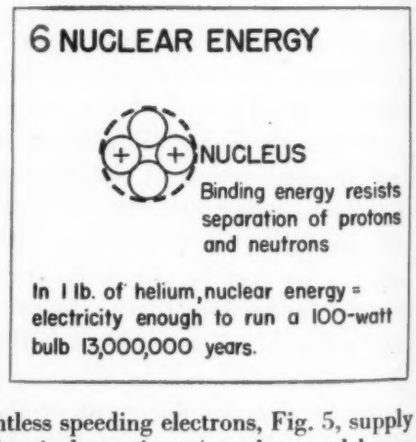


Each of the 92 elements has its own *atom*, yet all atoms are made from the same three pieces, Fig. 1: *proton* (weight 1, electric charge +1), *neutron* (weight 1, charge 0), *electron* (weight 0, charge −1).

Every atom is a tiny "solar system." Its central "sun" has one or more protons, generally neutrons too. The revolving "planets" are electrons, one for each proton in nucleus, because plus and minus must balance in the atom. The opposite charges attract, but high speed keeps the electrons out in their circular orbits, just as the centrifugal tendency of the revolving earth defies the sun's gravitational pull. All the weight of an atom is in the nucleus, so add the number of protons and neutrons to get the atom's weight. The *atomic number* is equal to the number of protons. The elements are known by their atomic numbers. Thus uranium (92 protons) is element 92.


4 ATOM SIZE
ELECTRON
NUCLEUS
Most of an atom is mere space
1/200,000,000 INCH
If the nucleus were a baseball, the electron would be a speck 2,000 ft. away


5 ELECTRON ENERGY
Energy of "motion"
ELECTRONS
They move at high speed but have only negligible mass
Energy values are relatively small


6 NUCLEAR ENERGY
NUCLEUS
Binding energy resists separation of protons and neutrons
In 1 lb. of helium, nuclear energy = electricity enough to run a 100-watt bulb 13,000,000 years.

With only their outermost orbits touching, it would take half a million atoms to span the thickness of a human hair. Yet if one could expand an atom until its outer orbits encircled 100 acres, the nucleus would be no bigger than a baseball. The atom is mostly empty space, Fig. 4, and nuclei are difficult targets; so much so that a neutron bullet fired at a mass of atoms may pass right through without a hit.

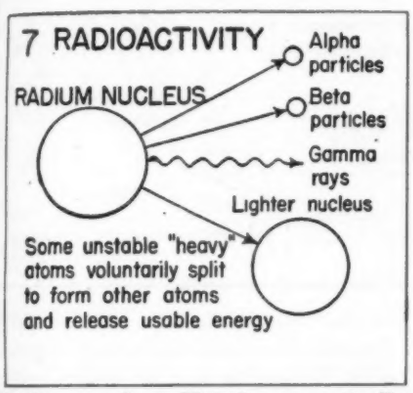
The almost weightless speeding electrons, Fig. 5, supply all the energy of chemical reactions (as when coal burns or TNT explodes). Evading all ordinary chemical action, the immensely greater energy bound up in the nucleus, Fig. 6, can be released only by direct hits on the nucleus to break the bonds that hold the protons and neutrons in a tight bundle.

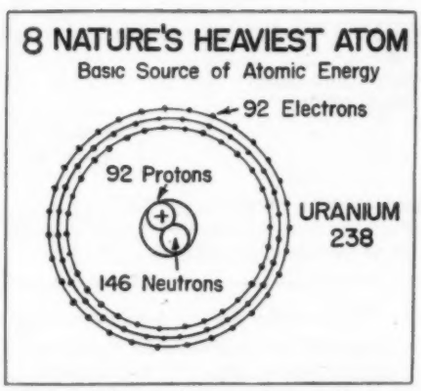
RELEASES ENERGY

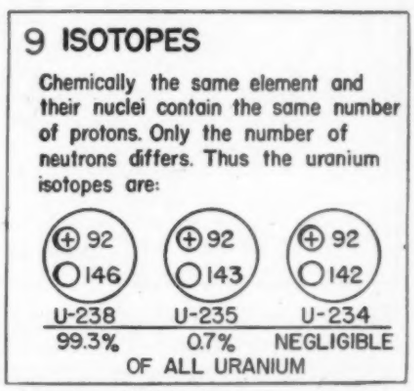
the fantastic course of atomic engineering through the five years of news blackout. It leaves no doubt that only a complete mobilization of America's technical resources could have won this victory in time.

Other writers in other places will unfold the epic story. This presentation leaves no space to reflect the glory of the accomplishment or even to record its history. The aim is more immediately practical — to give the professional and business readers of the McGraw-Hill publications a sound and honest, though non-technical, understanding of this atom-smashing business, so that they will know better what to do about it in their personal and business lives.

Now for step one: learning the shape of atoms and how atom splitting releases energy.

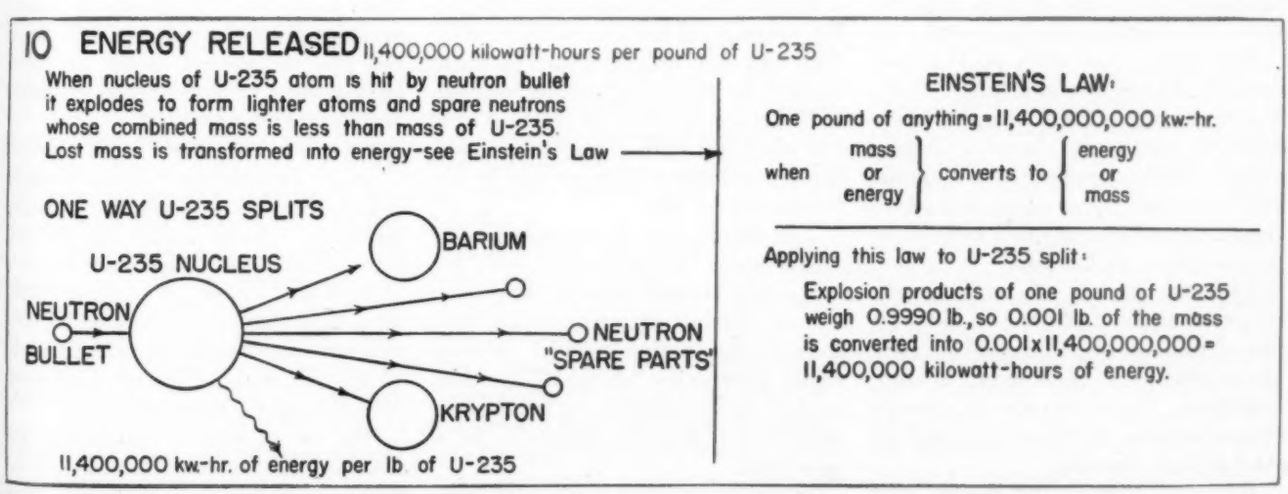






Radium nucleus, Fig. 7, automatically emits particles and energy as it decays to form nuclei of a lighter atom. Most common form of uranium, nature's heaviest atom, is Uranium 238, Fig. 8. This form is not directly useful for energy release, but is important as the raw material for a new synthetic power atom, *plutonium*.

An element may have several *isotopes* — alternate forms with the same number of protons but slightly different numbers of neutrons. Uranium 238 is the isotope in which protons and neutrons total 238 (so atom weight is 238). It is 99.3% of the total weight of pure, natural uranium. The stuff needed for direct atomic-energy release is Uranium 235, only 0.7% of the total weight and very difficult to separate from 238. To put it another way, every pound of energy-giving U-235 comes mixed with a dead load of 140 pounds of relatively inert U-238.

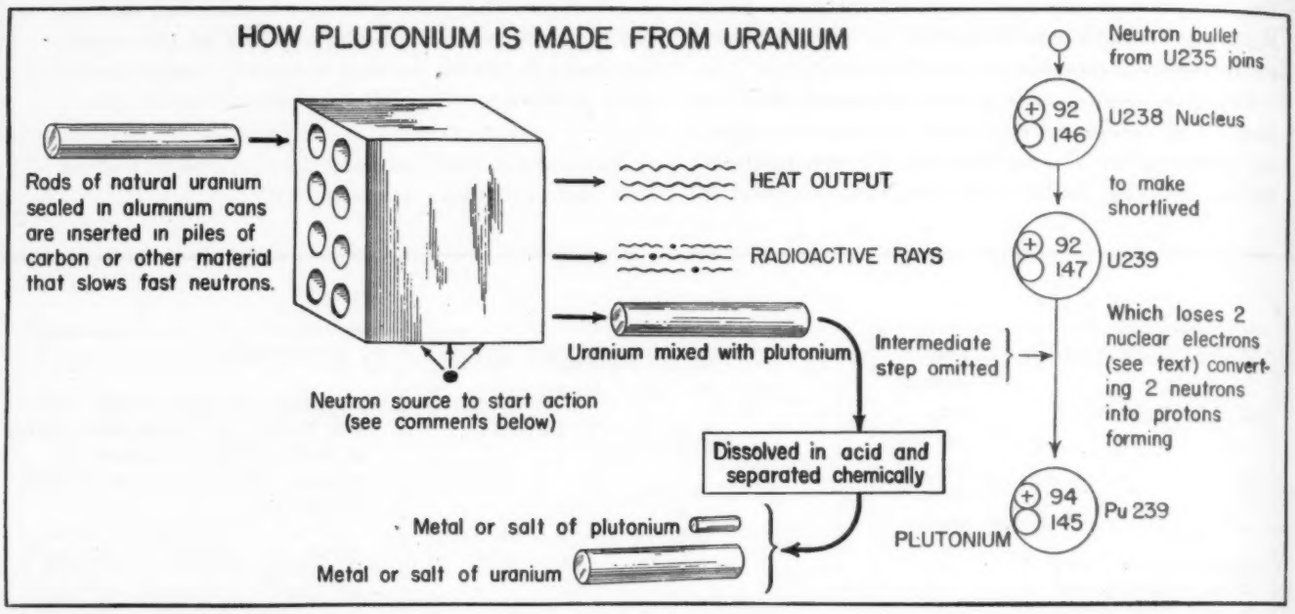

10 ENERGY RELEASED 11,400,000 kilowatt-hours per pound of U-235
When nucleus of U-235 atom is hit by neutron bullet it explodes to form lighter atoms and spare neutrons whose combined mass is less than mass of U-235. Lost mass is transformed into energy-see Einstein's Law
ONE WAY U-235 SPLITS
U-235 NUCLEUS
BARIUM
NEUTRON BULLET
NEUTRON "SPARE PARTS"
KRYPTON
11,400,000 kw-hr. of energy per lb of U-235
EINSTEIN'S LAW:
One pound of anything = 11,400,000,000 kw-hr.
when mass or energy converts to energy or mass
Applying this law to U-235 split:
Explosion products of one pound of U-235 weigh 0.9990 lb., so 0.001 lb. of the mass is converted into 0.001 x 11,400,000,000 = 11,400,000 kilowatt-hours of energy.

Slow neutron bullet splits Uranium 235 nuclear target, generating two lighter atoms (Fig. 10 shows one possibility) and several free neutrons ready to split other U-235 atoms. The following pages show how the original neutron may be produced and directed and how a chain of self-propagating atomic explosions may sweep through a block of U-235 like a forest fire to release heat energy equivalent to 11,400,000 kilowatt-hours per pound.

CONTINUED ON NEXT PAGE

CREATING and ISOLATING

Man-Made Plutonium—U-235 Substitute


HOW PLUTONIUM IS MADE FROM URANIUM
Neutron bullet from U235 joins
92 146 U238 Nucleus
to make shortlived
92 147 U239
Which loses 2 nuclear electrons (see text) converting 2 neutrons into protons forming
94 145 Pu 239
PLUTONIUM
Rods of natural uranium sealed in aluminum cans are inserted in piles of carbon or other material that slows fast neutrons.
HEAT OUTPUT
RADIOACTIVE RAYS
Uranium mixed with plutonium
Intermediate step omitted
Neutron source to start action (see comments below)
Dissolved in acid and separated chemically
Metal or salt of plutonium
Metal or salt of uranium

We now have two kinds of atoms suitable for energy supply, Uranium 235 and the new man-made element No. 94, plutonium. Uranium, No. 92, has the heaviest atom of any natural element.

The Manhattan Project's plant, on the Columbia River at Hanford, Washington, is the world's greatest atom-making factory. Devoted entirely to the mass production of plutonium atoms, it uses U-238 as the raw material and U-235 as the energy source, intimately mixed in the same proportions as in natural uranium metal.

The production units at Hanford are several huge uranium "piles." Each is a very large block of graphite with holes in which are placed uranium-metal cylinders, sealed in aluminum cans to protect the uranium from corrosion by the cooling water constantly pumped through the pile.

Each pile runs itself, so to speak. Not even the conventionally pictured bits of radium, beryllium and paraffin are needed as a "pilot light" to start operation. There are always enough stray neutrons, or even cosmic rays, to start a chain reaction.

But once started, the design, size and control of the unit must be such that the chain reaction will continue at an even rate — neither die down nor overshoot into an explosion.

To see this picture in atomic terms, consider the fraction of a second in which one million U-235 nuclei are split, producing two million lighter atoms (say, one million of barium and one million of krypton) and between one and three million fast-moving neutron projectiles.

Some of these escape in free flight right through the relatively vast atomic "open spaces." Some are "captured" by the many U-238 nuclei, and others are captured by the impurities. But, on the average, of the one to three million, just one million neutrons must succeed in smashing another million U-235 atoms in the next fraction of a second. Thus, with reproduction rate exactly maintained, life goes on in the atomic-energy pile.

The carbon, one of several possible "moderators," serves to slow down the neutrons without capturing many. The chance of a fast, straight-moving neutron hitting a tiny nucleus is very small, whereas the "slow ball" neutron is likely to be sucked in by the nuclear attraction if it would otherwise be a near miss.

From the practical angle, maintaining a chain reaction requires careful design and good controls. The pile must be slightly larger than actually necessary for a chain reaction (that means scores of tons of material). Controls must be sensitive and dependable. They slow the pile down to the balancing point by sliding in retarders, such as strips of cadmium.

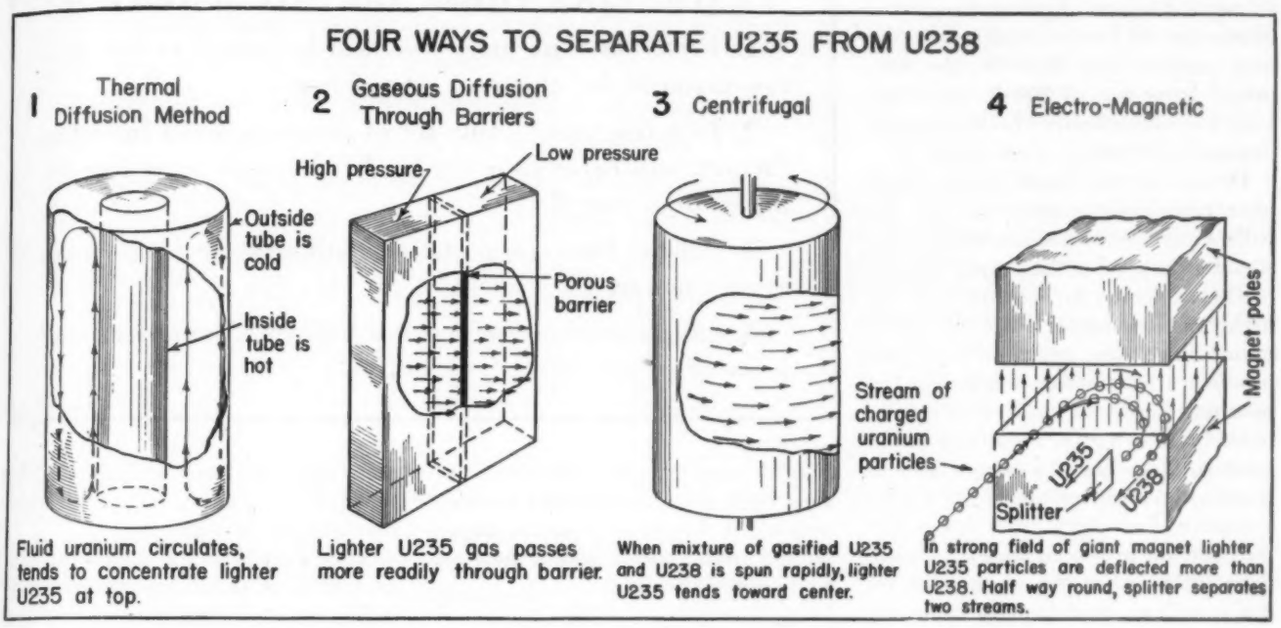
As already noted elsewhere, the energy released is about 11,400,000 kilowatt-hours for each pound of U-235 split. This energy appears first in the high speed of the pieces thrown off by the atomic split, then is converted to sensible heat as collisions slow down these projectiles. The energy is finally removed from the pile in the form of hot air, steam, hot water or other heated fluid in commercial quantity and thermal condition.

Such piles, operated with normal uranium, or with uranium enriched in U-235, would seem to be the primary means by which atomic energy will serve (if ever) as a commercial source of heat and power. Plutonium would be a byproduct, but might under certain conditions add to the energy yield of the pile without the need to separate it from the uranium.

The use of normal uranium in the Hanford pile sounds extremely attractive as a heat source, but has certain economic disabilities. Only a small part of the U-235 is used up before the pile must be shut down to remove the plutonium.

THE HIGH-POWER ATOMS

Isolating U-235 — a Gigantic Task


FOUR WAYS TO SEPARATE U235 FROM U238
1 Thermal Diffusion Method
2 Gaseous Diffusion Through Barriers
3 Centrifugal
4 Electro-Magnetic
Outside tube is cold
Inside tube is hot
High pressure
Low pressure
Porous barrier
Stream of charged uranium particles
Magnet poles
U235
U238
Splitter
Fluid uranium circulates, tends to concentrate lighter U235 at top.
Lighter U235 gas passes more readily through barrier.
When mixture of gasified U235 and U238 is spun rapidly, lighter U235 tends toward center.
In strong field of giant magnet lighter U235 particles are deflected more than U238. Half way round, splitter separates two streams.

Many of the uranium ores, including most samples of pitchblende and carnotite, will yield from 1 to 15% metallic uranium. Chemical separation of the metallic "natural" uranium is simple. Whatever the source, natural uranium contains the three isotopes in the constant proportions of 99.3% U-238 and 0.7% U-235, with traces of U-234.

Separating the U-235 from U-238, an operation essential for explosive uses of U-235, and probably important for future commercial controlled-chain piles, has been most difficult. Chemical separation was impossible because U-235 and U-238 are chemically the same.

The only possibility was a separation by physical differences, primarily a one percent difference in weight. The porous barrier and centrifugal methods pictured above required vaporizing a salt of uranium. All the methods shown have been used or tried on the Manhattan Project. All require many stages to achieve a substantial concentration of Uranium 235.

Dollarwise Thoughts on Atomic Energy

Costs mean little in war, but peacetime uses of U-235 and plutonium must pass the dollar test in competition with coal, fuel oil, natural gas, gasoline and electricity.

On the basis of energy costs only, "*all other things being equal,*" the table on the last page of this section shows at what price per pound U-235 would give the same energy cost as conventional energy sources selling at the indicated prices. For such comparisons it is convenient to remember that one pound of U-235 is equal (energy-wise) to about 11,400,000 kilowatt-hours, also to 1500 tons of coal, or 200,000 gallons of gasoline.

Fuel engineers understand the limitations of such oversimplified comparisons. Others should be warned that "all other things" are never equal. With this thought in mind, reconsider the uranium piles operated at Hanford to produce plutonium. These use U-235 in the cheapest form, say about $1400 per lb., assuming purified normal uranium at $10 per lb. (140 lb. of uranium contains one pound of U-235.)

If this were the whole story, coal would have to sell for a dollar a ton to break even with U-235 as a water heater. However, the pile using normal uranium must be immense to hold its own in a chain reaction. More important, the accumulating fission products "poison" the reaction after only a small part of the U-235 has been used up. Then the uranium cylinders must be removed for plutonium recovery. Finally, it has not yet been found possible to operate the normal-uranium piles at high enough temperatures for practical power production.

If we go to the other extreme and build a small pile, using concentrated U-235, we shall run into excessive material costs, perhaps several times the $52,000 per lb. set down in the table as the equivalent of 20-cent gasoline.

Something between the two extremes is likely to prove the most economical —perhaps a pile operating on a U-235 concentration between 1 and 10%.

The engineer of the "atomic-power age" must know the price of Uranium 235 *in various concentrations* and the characteristics of piles suited to them. No such information is yet available. He must also watch the danger from radio-activity; the requirements for radiation shields; explosion hazards, etc.

CONTINUED ON NEXT PAGE

WHAT TO EXPECT

Before discussion of possible and probable future applications of atomic energy to the arts of peace, the atomic bombs should have consideration. We may assume that these bombs contained from two to 200 lb. of either U-235 or plutonium, or both. No more precise information is available.

Details of the bomb design have been completely suppressed, but the following basic considerations are stated or implied in the Smyth Report:

The explosive in a bomb must be highly concentrated U-235 or plutonium. Since slow neutrons could not produce a satisfactory explosion, the neutron retarder or *moderator*, is minimized. This, in turn, requires a U-235 mass so large that the escape of neutrons without hitting nuclei will not be excessive. For every 1000 atoms hit, the neutrons produced must split more than 1000 new atoms, so that the reaction will proceed rapidly in an expanding chain, as sketched below.

There can be little leeway in the size of the explosive charge. For a given shape there is a certain "critical" weight of material. If this is exceeded the bomb explodes instantly. If the weight of charge is less than the critical, it cannot be made to explode.

Therefore, the critical mass must be created at the moment of explosion.

The Smyth Report suggests that this can be accomplished by breaking down the charge into two or more well-separated parts, each having less than the critical mass. At the appointed moment these could be brought together within the bomb to create a supercritical mass, which would then explode automatically.

CLAIMS LIKE THESE ARE NOT JUSTIFIED

1. Pretty soon no more coal will be mined except as a raw material for chemical manufacture.

2. In a few years a tiny bit of uranium, built in at the factory, will drive your car for life through an engine no bigger than your fist.

3. All the big central stations will soon be running on atomic power.

4. Cheap atomic energy will enormously reduce the price of power.

Peacetime Applications

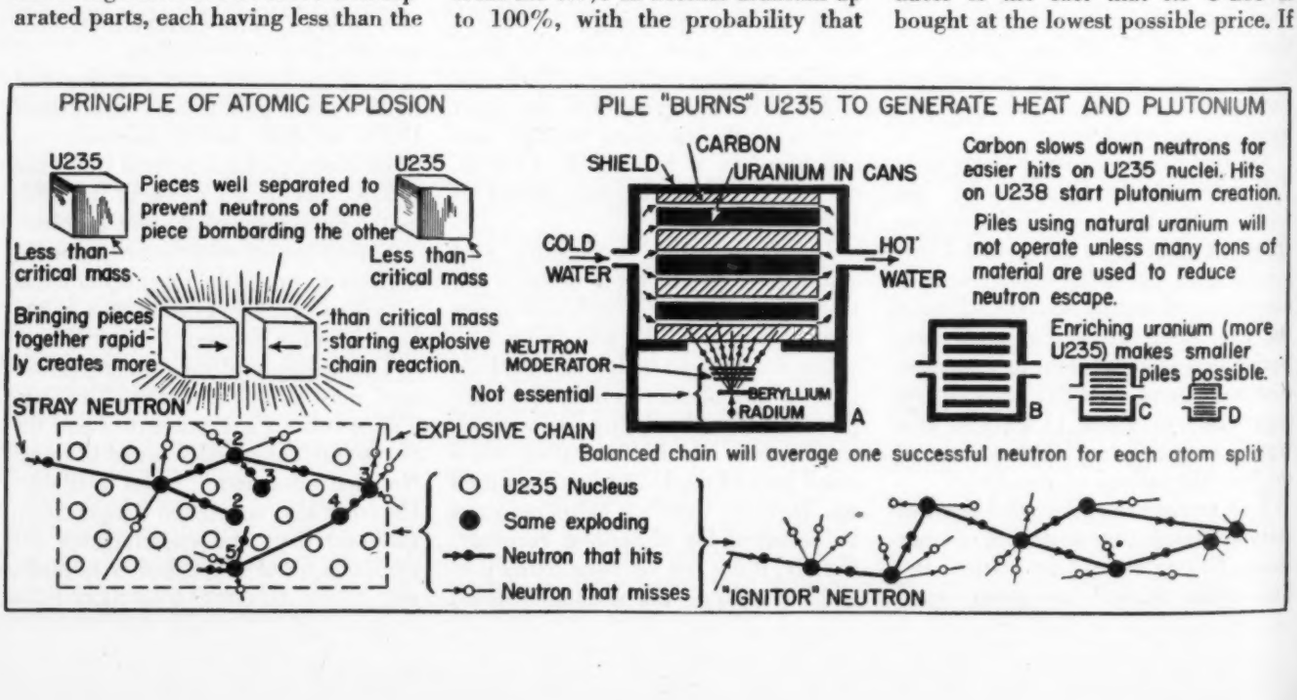
Except possibly for superblasting operations, uncontrolled explosive reactions cannot be permitted in the peacetime use of atomic energy. This means that the quantity of U-235 assembled in any one spot must always be kept well below the critical weight to avoid spontaneous explosion.

Depending on the particular application, the most desirable concentration of U-235 may range anywhere from the 0.7% in normal uranium up to 100%, with the probability that many industrial applications will find the greatest economy in concentrations between 1% and 15%.

This matter of the degree of concentration of U-235 has received little public attention, yet nothing could be of greater practical importance. To make this point clear, consider the two extremes, 0.7% of U-235 and 100% of U-235, respectively.

The Hanford pile, using normal uranium (0.7% U-235) with carbon moderator, must be very large to work at all. It is inefficient in the sense that it must be shut down after a small part of the U-235 has been consumed. It cannot operate at high temperatures.

Its great advantage as a heat producer is the fact that its U-235 is bought at the lowest possible price. If many industrial applications will find


PRINCIPLE OF ATOMIC EXPLOSION
U235
Pieces well separated to prevent neutrons of one piece bombarding the other
U235
Less than critical mass
Less than critical mass
Bringing pieces together rapidly creates more than critical mass starting explosive chain reaction.
STRAY NEUTRON
EXPLOSIVE CHAIN
U235 Nucleus
Same exploding
Neutron that hits
Neutron that misses
"IGNITOR" NEUTRON
PILE "BURNS" U235 TO GENERATE HEAT AND PLUTONIUM
SHIELD
CARBON
URANIUM IN CANS
COLD WATER
HOT WATER
NEUTRON MODERATOR
Not essential
BERYLLIUM
RADIUM
A
B
C
D
Carbon slows down neutrons for easier hits on U235 nuclei. Hits on U238 start plutonium creation.
Piles using natural uranium will not operate unless many tons of material are used to reduce neutron escape.
Enriching uranium (more U235) makes smaller piles possible.
Balanced chain will average one successful neutron for each atom split

FROM ATOMIC ENERGY

. . . BUT REMEMBER THESE FACTS

1. The large-scale, controlled release of heat energy from U-235 has been fully demonstrated.

2. Beyond question, this energy could be applied directly for heating water and air, and making steam.

3. Such heat, in turn, could be applied directly, or converted into mechanical power or electricity by conventional steam turbines and gas turbines.

4. If and when U-235 in concentrations up to 10% costs less than $25,000 per lb., it may find applications, but will compete, at first, with premium fuels rather than coal.

purified normal uranium sells for, say, $10.00 per lb., the price of 140 lb. (containing one lb. of U-235) will be only $1400. This would be a very favorable price if the pile could operate efficiently with the 0.7% U-235.

Concentrating the U-235 to 100% would permit a much more compact and convenient pile — perhaps little more than small pieces of U-235, encased in aluminum to ward off corrosion, and immersed in a tank of water; this should convert the water into steam at a regulated rate.

In large part, the control would be inherent. The water as a moderator would keep the chain going, but if the reaction got too violent, the resulting higher superheating of the steam would decrease the moderator effect and thereby hold the reaction in check. Yet even if all this comes true the cost of concentrated U-235 in the near future will be many times $10,000 per lb.

Running up the concentration only a few percent above that in normal uranium may prove to be the way to get reasonable pile size and good efficiency without incurring exorbitant concentration costs.

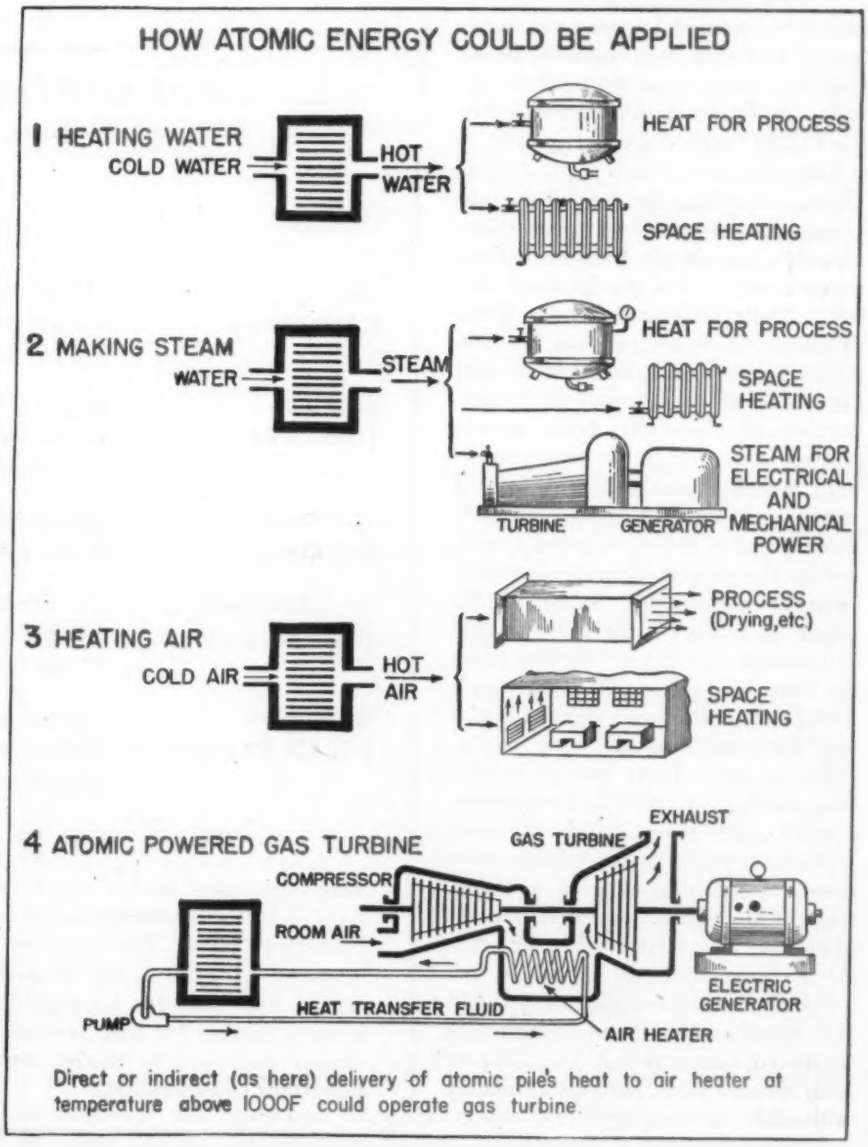
When atomic energy is applied, the starting point is heat, picked up by water, air or a special heat-transfer fluid. Intermediate heat transfer fluids may be essential in certain applications (space heating and service water, for example) where people must be protected from injury by radioactivity.

The intermediate heat-transfer fluid shown for the gas turbine would, of course, have to operate at temperatures up to 1200 F. There seems to be no basic reason why the pile itself could not be built inside the compressed-air receiver, discharging its heat directly to the compressed air.

With rather high concentration of U-235, this arrangement might be suitable for large airplane drive if excessive weight of radiation shields could be avoided.

Also, presumably, rockets and planes of the "buzzbomb" type could be powered by atomic heat delivered to the air of the jet steadily, not in puffs.

The sketches stress direct applica-



Direct or indirect (as here) delivery of atomic pile's heat to air heater at temperature above 1000F could operate gas turbine.

THESE THINGS MIGHT RESTRICT USE OF ATOMIC ENERGY

1. Ineffectiveness of large piles using normal U-235 concentration
2. High cost of concentrated U-235 for smaller, more effective piles
3. Danger from radioactivity
4. Weight and cost of shielding against radiation
5. Explosion hazard
6. Possible short supply of uranium
7. Governmental restrictions on atomic-energy materials

tions of hot air, steam and hot water to process and space heating. This emphasis is justified by the often overlooked fact that such applications of heat have many times the total energy value of all the electricity generated in the United States for all purposes.

There has been much popular speculation regarding the type of engines required for atomic-power generation. The answer is simple. Present engines, steam turbines and gas turbines can be used with little or no change. This, of course, does not rule out the possible discovery of specialized engines for atomic power, or even direct production of electricity from atomic energy.

In the long run the implications of atomic power are staggering for both war and peace. However, popular writers on the subject have undoubtedly created unreasonable hopes in the minds of readers — for example, the expectation that in two or three years the Detroit builders will market cars with built-in "lifetime" slugs of U-235 and "fist-sized" engines.

Yet it seems fairly safe to predict that atomic energy will find some commercial applications within the next five or ten years, first, probably, as a premium fuel like aviation gasoline, worth a fancy price for specialized applications where low weight or some other characteristic is important.

As the cost of concentrating U-235 is reduced and application efficiencies improved, atomic energy may compete with cheaper fuels, perhaps ultimately with coal.

Important non-power applications of atomic energy may well include the ultra-high-temperature processing and fabricating of materials — also, modern "alchemy": building and rebuilding atoms to create new elements and to produce old elements at lower costs.

Radioactivity obtained directly or indirectly from artificial atom-splitting should find many important medical and industrial applications.

Turning back to ordinary power applications, we must avoid the temptation to overstress the economic importance of lower-cost power fuel. Fuel cost is only about 17% of the gross receipts of the electric utilities. Here's another way to put it: If, after allowing for transmission losses, one kilowatt-hour delivered to the consumer from modern plants represents a coal consumption of 1.5 lb., and if the coal costs $5.00 per ton cancellation of the coal bill could not save more than ⅜ of a cent per killowatt-hour. And atomic fuel will certainly not be free.

Performance of the atomic bomb is a monument to the scientists who unlocked the secrets of the atom and suggested the basic technique of making plutonium and concentrating U-235.

From there on, the job was at least 50% engineering. The various big plants of the Manhattan Project are vast assemblages of pipes, tanks, boilers, valves, instruments and controls, installed and operated by engineers, largely designed by engineers. From now on, the speed with which atomic power becomes practical will depend on the effectiveness of the engineer-scientist team.

It is possible, of course, that national controls may completely upset the entire technical and economic pattern of this discussion. For reasons of national security the government may decide to control or restrict atomic-power materials, plants and operations in ways not yet determined.

U-235 COULD COMPETE AT THESE PRICES

other things being equal

Common fuel	*Assumed prices*	*Comparable prices for Uranium 235, dollars per pound (nearest thousand)*
COAL (13,000 B.t.u.)	$6 per ton	$9,000
	$12 per ton	$18,000
	$15 per ton	$23,000
FUEL OIL (150,000 B.t.u. gal.)	2¢ per gal.	$5,000
	4¢ per gal.	$10,000
	8¢ per gal.	$20,000
CITY GAS (500 B.t.u.)	50¢ per 1000 cu. ft.	$39,000
	$1 per 1000 cu. ft.	$78,000
NATURAL GAS (1000 B.t.u.)	25¢ per 1000 cu. ft.	$10,000
	50¢ per 1000 cu. ft.	$20,000
	$1 per 1000 cu. ft.	$40,000
GASOLINE (150,000 B.t.u. gal.)	10¢ per gal.	$26,000
	20¢ per gal.	$52,000
	30¢ per gal.	$78,000

BUT

Note that "other things" are never equal. U-235 in normal uranium form is by far the cheapest, but involves use of excessively large and inefficient "piles." The unit cost of the U-235 in enriched mixtures increases with the degree of enrichment. Over-all cost comparisons can be made only for a specified concentration of U-235 and for apparatus suitable for that particular concentration. Possible explosion danger and need to protect personnel against radiation are other important considerations.

Four-Way File for Better Handling of Suggestions

E. F. FISK, Industrial Engineer, The Glenn L. Martin-Nebraska Company, Omaha

A TECHNIQUE FOR PEACETIME PRODUCTION

ALTHOUGH MUCH has been written on the effectiveness of suggestion systems used in industry, little has been said about the "behind-the-scenes" handling of these suggestions.

In the early days of the suggestion system at The Glenn L. Martin-Nebraska Company, Omaha, a conventional filing system was satisfactory, but as suggestions increased in volume, it became apparent that the records lacked flexibility and would soon become inadequate. It became increasingly difficult to obtain information quickly and accurately. The suggestion group found themselves unable to cope with such questions as:

1. How many suggestions has John Doe submitted and how many were accepted?

2. What suggestions have been submitted on merit rating? On the cafeteria? On burring tools? Which were accepted?

3. Who investigated Suggestion No. 1296, and on what day did it come before the committee for consideration? What award was paid? Did the employee collect his award?

Analyzing the problem in the light of these deficiencies, it was evident that a revised filing procedure must record and make convenient the following information:

1. Preliminary data—name of employee, his department, and the date suggestion was received.

2. Type of suggestion submitted.

3. Investigation history—date suggestion was investigated, name of investigator, and committee action on the suggestion.

To meet this need, a cross-indexing system was developed which is being used successfully at The Martin-Nebraska Company.

As a starting point, suggestions were grouped on the Dewey Decimal System into broad classes or types, set up by a review and classification of all early suggestions, until a satisfactory grouping-point was established. The classifications are shown on pages 113 and 114.

A second control was devised with the adoption of the suggestion group's own serial numbers. Formerly the number printed on the suggestion blank (the stub of which the employee keeps as a receipt) served to identify the suggestion to the suggestion group as well. Because unused blanks were lost, continuity was disrupted.

The suggestion clerk, on the receipt of each new suggestion, now stamps it with the serial number, making out in triplicate the form illustrated below. She briefs the suggestion, classifying it according to the decimal system. After the employee's department number and the date the suggestion is received are entered on the form, the sugges-

1296 No.	526.8 Type	A8270 Serial No.	11 Dept.	That music be played over the public address system in Cafeteria during lunch period

Date Received	Date and Investigator		Date of Committee	Committee Action			Reason
	Issued	Returned		Reinvest.	Accept	Reject	
12/15/44	12/16/44						
	By Halsey						
	Reinvestigation						

Clock No. 11 - 106	Date Collected Award
Employee Name John Doe	

Suggestion cards with all essential information are typed in triplicate. Cross-indexed by type, serial number, and alphabetically, they provide complete information on any suggestion at any moment

I. Factory

1. Handling

1. Storing
2. Transporting (internal)
3. Supporting (trestles, platforms)
4. Holding (fixtures, vises, clamps)
5. Loaning (toolcribs)
6. Shipping
7. Lifting or pulling devices
8. Supplying air, water, material

2. Blanking or Cutting to Size

1. Casting
2. Extruding
3. Forging
4. Molding
5. Nibbling
6. Punching
7. Routing
8. Sawing, cutting with acetylene torch
9. Shearing

3. Preparing

1. Burring or burnishing
2. Filing
3. Grinding, honing
4. Sanding
5. Sandblasting
6. Polishing
7. Heat-treating
8. Anodizing
9. De-greasing, cleaning, masking, calking

4. Measuring or Marking

1. Color coding
2. Scribing
3. Stamping, tagging, labeling
4. Weighing
5. Counting
6. Gaging, templet
7. Scaling
8. Leveling or surveying
9. Indicating, micrometer

5. Detail Manufacture

1. Making holes (boring, drilling, reaming, punching, broaching)
2. Tapping or threading
3. Milling, planing, or shaping
4. Machining
5. Spotfacing or backfacing
6. Countersinking
7. Forming, bending

6. Fastening (Assembly or Installation)

1. Riveting
2. Spot welding
3. Welding and brazing (arc or gas), soldering
4. Bolting or screwing
5. Nailing
6. Gluing
7. Sewing
8. Safety wiring
9. Special

7. Finishing

1. Painting
2. Plating
3. Par Al Ketone
4. Zinc chromate
5. Decals or lettering
6. Fabric covering
7. Pickling engines
8. Oiling machinery

8. Testing or Inspection

1. Receiving inspection
2. Detail inspection
3. Laboratory inspection
4. Assembly inspection
5. Final assembly inspection
6. Flight test inspection, ground, plane traffic; control tower
7. Air Corps inspection
8. Tool inspection

9. Conserving or Salvaging

1. Sorting
2. Cleaning
3. Segregating
4. Reworking
5. Preventing waste
6. Utilizing for other purposes

II. Improvement of Product or Change of Design

1. Fuselage
2. Equipment
3. Armament
4. Hydraulics and landing gear
5. Instruments
6. Power plant
7. Electric and radio
8. Wing
9. Surfaces and controls

III. Building and Field

1. Internal
2. External

IV. Clerical

1. Recording

1. Composing
2. Computing
3. Drafting
4. Filing
5. Reproducing
   - .1 Photograph
   - .2 Blueprints
   - .3 Production illustration
   - .4 Ditto and mimeograph
6. Typing
7. Inventory
8. Equipment
9. Procedure

2. Conserving or Salvaging (Office Supplies)

1. Re-use of materials or supplies
2. Preventing waste

V. Employer-Employee Relations

1. Protecting Health and Safety

1. Hygiene and cleanliness
2. Safety practices (general)
3. First aid or hospital service
4. Hospital pass
5. Rest periods
6. Drinking fountains
7. Toilets and lavatories
8. Air conditioning and ventilation
9. Janitor service

2. Special Services

1. Transportation and rationing
   - .1 Taxi pass
   - .2 Gas rationing, tire rationing
   - .3 Riders
   - .4 Traffic problems
   - .5 Bus
   - .6 Protection
2. Recreation
   - .1 Athletics
   - .2 Bowling
   - .3 Bomber club
   - .4 Sings
   - .5 Band
3. Education
   - .1 Classes
   - .2 Library
   - .3 Books, purchase of
   - .4 Moving pictures
4. Publicity
   - .1 Signs
   - .2 Slogans
   - .3 "Marauder"
   - .4 "Martin Star"
   - .5 Photographs
   - .6 Rallies
5. Miscellaneous
   - .1 Employee suggestion service
   - .2 Donations
   - .3 Shop tips or plane tips
   - .4 Draft classification
   - .5 Parking lot or garage
   - .6 Lockers
   - .7 Lost and found
   - .8 Smoking areas
   - .9 Phone booths
6. Cafeteria
   - .1 Dishes or silverware
   - .2 Food
   - .3 Layout
   - .4 Personnel

FUNCTIONAL FILE

.5 Camouflage building, lunch wagon
.6 Refreshment stands
.7 Equipment
.8 Music

3. Agreement between company and employee

1. Hours of work
2. Rate of pay
3. Method of pay
4. Tax withholding
5. F.I.C.
6. Insurance
7. Bond purchase, deductions
8. Badges or identifications
9. Job evaluation and merit rating
10. Purchase of tools at commissary

4. Problems

1. Absenteeism
2. Personal problems
3. Morale
4. Personal tools and toolboxes

VI. Management

1. Public Relations

1. Visitors

2. Supervision

1. Responsibility of supervisors
2. Training

3. Policy

1. Relatives in same department
2. Vacation rules
3. Women smoking

4. Communicating

1. Mailroom service
2. Telephone, teletalk, and similar devices
3. Signal-clocks
4. Directories

5. Investigating

6. Planning

7. Timekeeping

1. Distribution of clerks
2. Time clocks
3. Transfers
4. AWOL

8. Placement of Employees

9. Manufacturing Services

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tion is checked out to an investigator.

The triplicate forms, plus the original employee suggestion blank, then serve as a four-way cross-reference file which is closely controlled by the clerk, with further information posted during the course of the investigation.

The four cross reference files are handled in this manner:

File No. 1—the original suggestion, filed by serial number. This file is the permanent storage file for the suggestion. It is used for reference only in case of a dispute or a need to refer to the employee's original suggestion. An "out card" placed in the file accounts for any suggestion withdrawn. This file thus serves as a historical record of original suggestions, including all original work and sketches.

Card File No. 2—filed by type number. This file indexes suggestions according to type. It enables the committee to find readily any or all suggestions on a similar subject. The serial number refers to the corresponding number in the original file. Often the card itself contains enough information to be sufficiently helpful for the committee's purposes.

Card File No. 3—filed alphabetically by employee name. This file groups all suggestions of an employee. It serves as a source of information for the plant's promotions board which, in reviewing a candidate's record for a supervisory job, is interested in the initiative and creativeness reflected in the number of suggestions submitted and put into effect.

Card File No. 4—filed by serial number. This file groups suggestions by serial number. It is used chiefly by the suggestion clerk as a control to see what suggestions have been received, which are in the process of investigation, and which are ready for committee action. From this file statistics for the suggestion group's monthly report to management can be obtained. This report indicates graphically: (a) The number of suggestions submitted, accepted, and rejected for the month; (b) the number and amounts of cash awards; (c) estimated savings through the suggestions.

Since the introduction of the indexing system the company has gone one step further by photographing suggestions on tools and layout which are labeled with the suggestion number. Suggested tools that are accepted are assigned a tool number. Employees receive royalties if the suggestions are patented. Practical suggestions are brought to the attention of the shop in a bimonthly publication, *Shop Tips*.

This suggestion system now functions efficiently and effectively with better control, more adequate and accurate records, and little additional effort. Not the least of its virtues is the quicker service on inquiries. To the employee, his suggestion is the best one yet. Now, for the first time, the harassed suggestion clerk has the proper tools for providing prompt and intelligent answers to those who ask about the status of their suggestions.

The American Way

What of the wages of the future? This question is bound to come up in any discussion of post-war planning.

On this, our attitude is clear. No wages are high that are earned. Fifty dollars a day *earned* is none too high. But a dollar a day *unearned* is much too high.

Wages are a part of the product. They are not the result of the employer's generosity, nor the employee's ability to bring pressure to bear.

American industry has continuously developed methods whereby a man receives more pay for fewer hours, but still increases production. And so it will continue to be.

—*Henry Ford and Henry Ford 2*

Using the Chart Method to Control Quality

HARRIS REINHARDT and EARLE BENSON, Project Quality Supervisors, Sylvania Electric Products, Inc., Ipswich, Mass.

QUALITY CONTROL CHARTS based on statistical methods have proved valuable in a wide variety of applications, and the use of these methods has been an important factor in enabling American industry to meet the unprecedented demands of the war production program for maximum production and uncompromising quality. Many quality men who could profitably make use of this new tool have been so burdened with the day-to-day problems of operating an inspection department that they have not found time to work out the details of a program of applying control chart methods to their particular problems.

The purpose of this article is to describe the details of a simplified procedure for applying quality control charts of the type illustrated in Figure 1, which show the percent defective of a product inspected on a "go" or "no-go" basis. This procedure has been used for some time in a number of Sylvania plants with gratifying results. The technique has been simplified to the point where it can be readily applied by persons whose mathematical background includes only ordinary arithmetic, and, since charts of this type can be applied in almost any type of industry, it is felt that this procedure provides an excellent starting point for anyone who wishes to give quality control chart methods a trial.

FOR LOW-COST PEACETIME OPERATION

The purpose of quality control charts is to provide control limits or "action" limits based upon past experience with the process under the particular conditions existing in the plant in question.

When the points fall within the limits, the process is said to be "in control." So long as the points stay within the limits, the process may be considered as being affected only by normal chance variations inherent in any manufacturing process. If a point falls outside the limits, it indicates (within a certain range of probability) that new causes have entered the system, and that a check-up to determine the nature of the new causes may be worth while.

In a chart showing percent defective, as in Figure 1, a point falling above the limits indicates that the new causes have increased the percent rejection above the level one

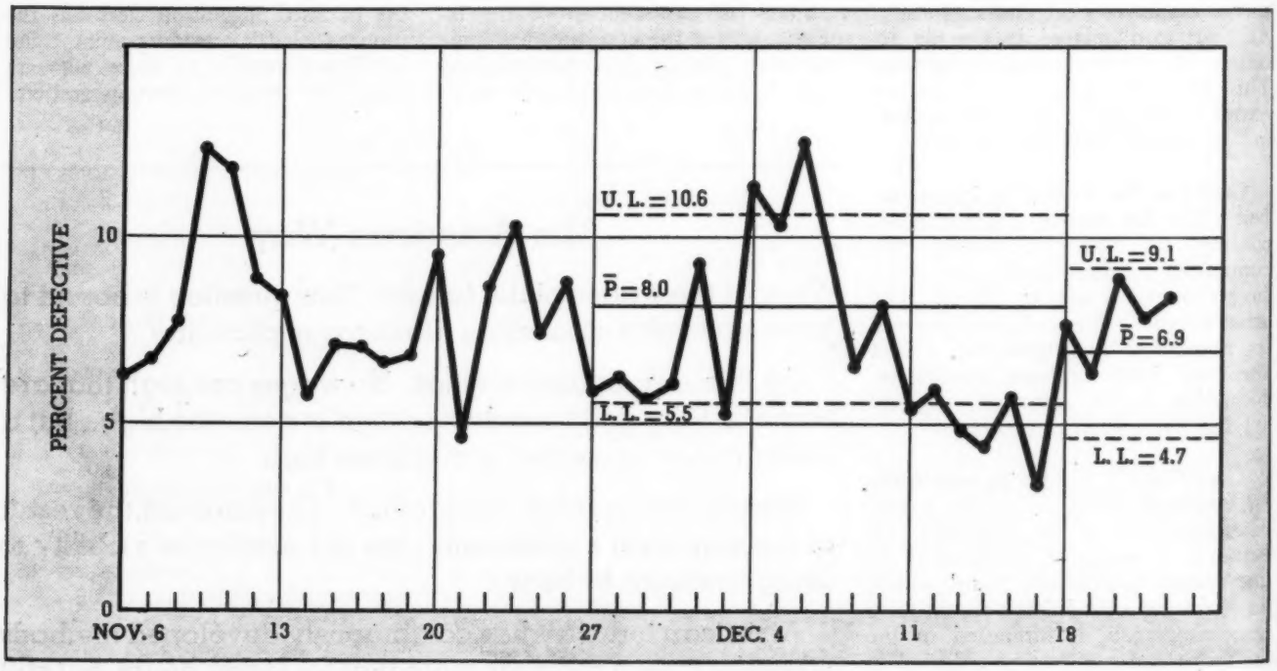


Figure 1. This chart is based on the data given in Figure 2. Data for the first 3-week period, beginning November 6, are used to compute the control limits for the second 3-week period, beginning November 27, giving an upper limit (U.L.) of 10.6 percent, and a lower limit (L.L.) of 5.5 percent. Data during the second 3-week period are used, in turn, to compute the limits for the next 3-week period

Table I. How to Compute the Control Limits

Control limits should be computed for each inspection station at the end of each three-week period in the following manner:

1. Obtain the "Total Inspections" and the "Total Rejections" at the inspection station during the period by adding up the figures in the "Inspection" and "Rejection" columns on the record sheet.

2. Compute *n*, the average inspections per day, by dividing the total inspections by the number of days included in the data for that inspection station.

3. Multiply the total rejections by 100 and divide the results by the total inspections to obtain $\bar{P}$, the average per cent rejections for the period. Enter this value of $\bar{P}$ in all of the three spaces provided on the record sheet.

4. Using the value of *n* determined in (2), find the corresponding value of *B* from the table supplied, and enter this value in the space indicated on the record sheet.

5. Using the value of $\bar{P}$ determined in (3), find the value of *A* from the table supplied, and enter this value in the space indicated on the record sheet.

6. Multiply *A* times *B* to obtain the product *AB*, and enter the results in the two spaces indicated on the record sheet, one by the + sign and the other by the — sign.

7. Add the value of *AB* to $\bar{P}$ to obtain the upper control limit in the space provided in the one column, and subtract *AB* from $\bar{P}$ to obtain the lower limit in the next column.

would expect from normal chance variations, and, therefore, an effort should be made to search out and eliminate the new causes. If a point falls below the limits, it indicates that the process has been improved, and that the causes of this improvement should be sought out and made a permanent part of the process. Of course, a point either above or below the control limits may be the result of tightening or relaxing the inspection standards, and these again are causes that should be located and corrected.

"Three-Sigma Limits"

Control limits calculated by the methods explained in this article are known in statistics as "three-sigma limits." Sigma is a Greek letter used to represent a quantity known in statistics as the "standard deviation." Statistical theory indicates that, when a process is in control, the chances are normally only 3 in 1000 that a point will fall outside limits equal to three times the standard deviation.

As previously pointed out, however, it is not necessary to understand the theoretical basis of control charts in order to apply them successfully to the common type of problem described herein.

The only data needed in order to apply the control chart methods described in this article are records of the number of inspections and the number of rejections at each inspection station. The basis for rejection may be any type of defect that renders the article unacceptable, such as visual defects or measured characteristics that fall outside an acceptable range. The essential point in this connection is that the data at each inspection station must apply to a product manufactured under conditions where a constant effort towards uniformity is being made, and where inspections are made to well-defined standards.

In the following description it is assumed that the control charts are kept on a day-by-day basis, although the same methods may be applied to an hourly, weekly, or monthly basis, or, for that matter, to any reasonable time basis. The inspections may be made on a 100 percent basis, or they may be samples of a certain portion of the total production. The problem of drawing the limits is simplified if the number of inspections per day is reasonably uniform, as in the example.

The number of inspections and rejections at each inspection station is recorded for each day on a form illustrated in Figure 2, and the percent rejections at each inspection station are calculated and entered in the form as shown. At the end of an 18-day period, control limits are calculated by the method described in Table I, and drawn on the control chart, Figure 1, to apply to the next 18-day period. It is, of course, possible to use a period longer or shorter than 18 days if desired, but a period of either 15 or 18 days (covering a total working time of three weeks) seems a satisfactory balance between the various factors involved in many types of manufacturing operations.

Length of Period

The period should be long enough to contain sufficient data to give limits that are representative of the process and yet should not extend over a period so long that the limits become obsolete because of improvements in the process or of an increase in production, resulting in an increased number of inspections per day.

A simplified method of calculating the limits is given in Table I. A copy of these directions, or a suitable modification of them, together with copies of Tables II and III for the factors *A* and *B*, is supplied to the quality control clerk to whom this work is assigned. The qualification for this work is accuracy in handling figures and in drawing the charts. No knowledge of mathematics beyond ordinary arithmetic is required, although ability to operate a slide rule is helpful in the multiplication and division.

If Tables II and III for *A* and *B* do not cover the range of values encountered in the process, extensions of the values to cover the range desired may be computed by means of the equations shown in the box on page 118. which explains the basis of this simplified method of computing limits.

The method of calculating and drawing the limits, described in Table I and illustrated in Figure 1, is based on the assumption that the number of inspections per day is reasonably uniform. If this is not the case, separate limits should be calculated for any day or period of days during which the inspections are abnormally high or abnormally low, making use of the same value of average percent defective, but using the appropriate value for the number of inspections.

If at the end of any period the calculated upper limit comes out higher than during the previous period, it is recommended that the old limits

Table II. Values for Factor *A*

$\bar{P}$	*A*	$\bar{P}$	*A*	$\bar{P}$	*A*	$\bar{P}$	*A*	$\bar{P}$	*A*
0.1	0.0316	4.1	0.198	8.1	0.273	12.1	0.326	16.1	0.368
0.2	0.0447	4.2	0.200	8.2	0.274	12.2	0.327	16.2	0.369
0.3	0.0546	4.3	0.202	8.3	0.276	12.3	0.328	16.3	0.370
0.4	0.0631	4.4	0.204	8.4	0.277	12.4	0.329	16.4	0.371
0.5	0.0705	4.5	0.206	8.5	0.279	12.5	0.331	16.5	0.372
0.6	0.0772	4.6	0.208	8.6	0.280	12.6	0.332	16.6	0.372
0.7	0.0834	4.7	0.210	8.7	0.282	12.7	0.333	16.7	0.373
0.8	0.0890	4.8	0.213	8.8	0.283	12.8	0.334	16.8	0.374
0.9	0.0944	4.9	0.216	8.9	0.285	12.9	0.335	16.9	0.375
1.0	0.0995	5.0	0.218	9.0	0.286	13.0	0.336	17.0	0.376
1.1	0.105	5.1	0.220	9.1	0.287	13.1	0.337	17.1	0.377
1.2	0.110	5.2	0.222	9.2	0.289	13.2	0.338	17.2	0.378
1.3	0.114	5.3	0.224	9.3	0.290	13.3	0.339	17.3	0.378
1.4	0.118	5.4	0.226	9.4	0.292	13.4	0.340	17.4	0.379
1.5	0.123	5.5	0.228	9.5	0.293	13.5	0.341	17.5	0.380
1.6	0.127	5.6	0.230	9.6	0.294	13.6	0.343	17.6	0.381
1.7	0.130	5.7	0.232	9.7	0.296	13.7	0.344	17.7	0.381
1.8	0.134	5.8	0.234	9.8	0.297	13.8	0.345	17.8	0.382
1.9	0.137	5.9	0.236	9.9	0.299	13.9	0.346	17.9	0.383
2.0	0.140	6.0	0.237	10.0	0.300	14.0	0.347	18.0	0.384
2.1	0.143	6.1	0.239	10.1	0.301	14.1	0.348	18.1	0.385
2.2	0.146	6.2	0.241	10.2	0.303	14.2	0.349	18.2	0.386
2.3	0.150	6.3	0.243	10.3	0.304	14.3	0.350	18.3	0.387
2.4	0.153	6.4	0.244	10.4	0.305	14.4	0.351	18.4	0.387
2.5	0.156	6.5	0.246	10.5	0.306	14.5	0.352	18.5	0.388
2.6	0.159	6.6	0.248	10.6	0.308	14.6	0.353	18.6	0.389
2.7	0.162	6.7	0.250	10.7	0.309	14.7	0.354	18.7	0.389
2.8	0.165	6.8	0.252	10.8	0.310	14.8	0.355	18.8	0.390
2.9	0.168	6.9	0.254	10.9	0.312	14.9	0.356	18.9	0.391
3.0	0.171	7.0	0.255	11.0	0.313	15.0	0.357	19.0	0.392
3.1	0.173	7.1	0.257	11.1	0.314	15.1	0.358	19.1	0.393
3.2	0.175	7.2	0.258	11.2	0.315	15.2	0.359	19.2	0.394
3.3	0.177	7.3	0.260	11.3	0.316	15.3	0.361	19.3	0.394
3.4	0.180	7.4	0.261	11.4	0.318	15.4	0.362	19.4	0.395
3.5	0.182	7.5	0.263	11.5	0.319	15.5	0.362	19.5	0.396
3.6	0.185	7.6	0.264	11.6	0.320	15.6	0.363	19.6	0.397
3.7	0.187	7.7	0.266	11.7	0.322	15.7	0.364	19.7	0.397
3.8	0.190	7.8	0.267	11.8	0.323	15.8	0.365	19.8	0.398
3.9	0.193	7.9	0.269	11.9	0.324	15.9	0.366	19.9	0.399
4.0	0.196	8.0	0.271	12.0	0.325	16.0	0.367	20.0	0.400

Explanation of Calculation of Limits

The methods of computing control limits described in Table I provide a simplified procedure for obtaining the solution of the following equation for the three-sigma limits.

$$\text{Three-sigma limits} = \bar{P} \pm 3\sqrt{\frac{\bar{p}\,(1-\bar{p})}{n}} \times 100$$

$\bar{P}$ = average percent defective

$\bar{p}$ = average fraction defective, i.e., $\frac{\bar{P}}{100}$

n = average number of inspections

The expression following the $\pm$ sign in the above equation may be written:

$$\frac{\sqrt{\bar{p}\,(1-\bar{p})} \times 300}{\sqrt{n}}$$

Then if we let $A = \sqrt{\bar{p}\,(1-\bar{p})}$

and $B = \frac{300}{\sqrt{n}}$

Then the equation becomes:

Three-Sigma Limits = Average percent defective $\pm$ $A \times B$.

Values of *A* for various values of percent defective, and values of *B* for various value of *n* can be calculated and recorded in tables such as Tables II and III for the range ordinarily encountered and the computations carried out on the record sheet in accordance with the procedure outlined in Table I.

rather than the newly calculated limits be used. This is based on the assumption that the upper limit for percent rejections should gradually decrease as the process is brought in control, as should be the case if a constant effort is made to keep the rejections within the limits. Thus an increase in the upper limit may be regarded as reflecting a loss of control, which should not be tolerated.

Of course, an exception to this rule of never increasing the upper limit might be made if there has been a decrease in production sufficient to cause the change, or if there have been changes in the process methods, inspection standards, or personnel of such magnitude that the past limits become impracticable for the moment. It is always essential that the limits represent a condition it is practicable to obtain a good percentage of the time. Usually this is the case, because the limits are based on past experience with the particular conditions existing

Table III. Values for Factor *B*

n	B	n	B	n	B	n	B	n	B
1	300.00	31	53.88	61	38.40	91	31.44	210	20.70
2	212.13	32	53.04	62	38.10	92	31.26	220	20.22
3	173.19	33	52.23	63	37.80	93	31.11	230	19.77
4	150.00	34	51.45	64	37.50	94	30.93	240	19.35
5	134.16	35	50.70	65	37.20	95	30.78	250	18.97
6	122.46	36	50.01	66	36.93	96	30.60	260	18.60
7	113.40	37	49.32	67	36.66	97	30.45	270	18.25
8	106.08	38	48.66	68	36.39	98	30.30	280	17.93
9	100.00	39	48.03	69	36.12	99	30.15	290	17.61
10	94.86	40	47.43	70	35.85	100	30.00	300	17.32
11	90.45	41	46.86	71	35.61	105	29.25	310	17.04
12	86.61	42	46.29	72	35.37	110	28.59	320	16.77
13	83.22	43	45.75	73	35.10	115	27.96	330	16.52
14	80.19	44	45.21	74	34.84	120	27.39	340	16.26
15	77.46	45	44.73	75	34.65	125	26.84	350	16.05
16	75.00	46	44.22	76	34.41	130	26.31	360	15.81
17	84.75	47	43.77	77	34.20	135	25.80	370	15.60
18	70.71	48	43.29	78	33.96	140	25.35	380	15.39
19	68.82	49	42.87	79	33.75	145	24.90	390	15.20
20	67.08	50	42.42	80	33.54	150	24.48	400	15.00
21	65.46	51	42.00	81	33.33	155	24.09	410	14.81
22	63.96	52	41.61	82	33.12	160	23.72	420	14.64
23	62.55	53	41.22	83	32.94	165	23.34	430	14.46
24	61.23	54	40.83	84	32.73	170	23.01	440	14.31
25	60.00	55	40.44	85	32.55	175	22.68	450	14.13
26	58.83	56	40.08	86	32.34	180	22.35	460	13.98
27	57.75	57	39.75	87	32.16	185	22.05	470	13.83
28	56.70	58	39.39	88	31.98	190	21.67	480	13.68
29	55.71	59	39.06	89	31.80	195	21.48	490	13.55
30	54.78	60	38.73	90	31.62	200	21.21	500	13.42

in the process. If at any time they become obviously impracticable, they should be discarded and new limits computed.

Having worked out the details of the quality control program along the lines outlined above, and having operated the control charts over several weeks, in order to become familiar with the various factors involved, the next problem is that of selling the system to the persons responsible for the correction of out-of-control conditions in such a way that they will be constantly alert to try to keep within limits.

A quality control board, Figure 3, designed to summarize the information contained in the charts, has been found valuable, since it presents the essentials of the system in a way that is readily understood, even by persons to whom the control charts might seem complicated or uninteresting. On

FIRST INSPECTION

Date	Inspections	Rejections	Percent	Date	Inspections	Rejections	Percent
11/6	972	61	6.3	11/27	1061	63	5.9
11/7	943	64	6.8	11/28	1098	69	6.3
11/8	1058	82	7.7	11/29	1137	65	5.7
11/9	1121	139	12.4	11/30	1088	65	6.0
11/10	1080	127	11.8	12/1	1175	109	9.3
11/11	1040	94	9.0	12/2	1224	64	5.2
11/13	994	83	8.4	12/4	1081	122	11.3
11/14	1103	62	5.6	12/5	1203	123	10.2
11/15	998	71	7.1	12/6	1016	124	12.4
11/16	1053	74	7.0	12/7	1231	120	9.7
11/17	1059	70	6.6	12/8	1104	70	6.3
11/18	1002	68	6.8	12/9	1083	87	8.0
11/20	967	93	9.6	12/11	1312	70	5.3
11/21	1117	52	4.7	12/12	1241	71	5.7
11/22	1091	94	8.6	12/13	1174	58	4.9
11/23	992	102	10.3	12/14	1252	54	4.3
11/24	1034	76	7.3	12/15	1241	70	5.6
11/25	1017	90	8.9	12/16	1256	40	3.2
SUM	18641	1502			20977	1444	
AVE.	n = 1038	$\bar{P}$ = 8.04			n = 1199	$\bar{P}$ = 6.90	
	B = 9.30	A = 0.271			B = 8.66	A = 0.254	
P	8.04	8.04		$\bar{P}$	6.90	6.90	
A x B	2.52	2.52		A x B	2.20	2.20	
LIMITS	10.56 UPPER	5.52 LOWER		LIMITS	9.10 UPPER	4.70 LOWER	

Figure 2. Daily figures for inspections, rejections, and percent rejections may be recorded on a form like the one shown here. Limits are computed in the spaces at the bottom at the end of each 18-day period, in accordance with the simplified procedure explained in Table I

Figure 3. Colored indicating pegs on the quality control board show performance with respect to the control limits during the preceding day

this board the quality control status each day at each inspection station is indicated by colored pegs inserted in holes somewhat like a giant cribbage board. The board contains 31 holes in each row, numbered to represent the days of the month. Golf tees in three colors—green, red, and yellow—are used for pegs.

A *green* peg, indicating safety, is used if the process is within control. Above control is represented by a *red* peg, indicating danger. Below control is represented by a *yellow* peg, indicating that a certain degree of caution, particularly on the part of the inspection department, should be exercised to make sure that the change represents a real improvement in quality, and not a shift in inspection standards or laxity in inspection methods.

The board with the colored pegs in place makes an attractive and attention-compelling display. Placed in a position where it is seen by the entire production department, it creates considerable comment regarding its meaning and purpose. The significance of the pegs is readily grasped even by persons who have no knowledge of control chart technique, and to whom a control chart would appear complex or uninteresting. With a little encouragement, a healthy spirit of competition is developed between various groups, and is reflected in an over-all improvement in quality level.

The development of a spirit of friendly competition between production groups has been carried still further by mounting red, green, and yellow lamp bulbs at important inspection stations. They should be mounted so that they are visible to all persons directly involved in manufacturing the product inspected at that station. The appropriate bulb can be lighted at the end of each hour or other suitable period to indicate the performance with respect to the quality control limits during the preceding period. By bringing conditions of high rejections to the attention of everyone involved at the time the conditions are occurring, the use of these bulbs may be an important means of getting immediate corrective action.

Before the quality control board is placed on the production floor, it is recommended that the production group be called together and the purpose and general significance of the board explained to them. Some of the points to stress in this explanation are given below:

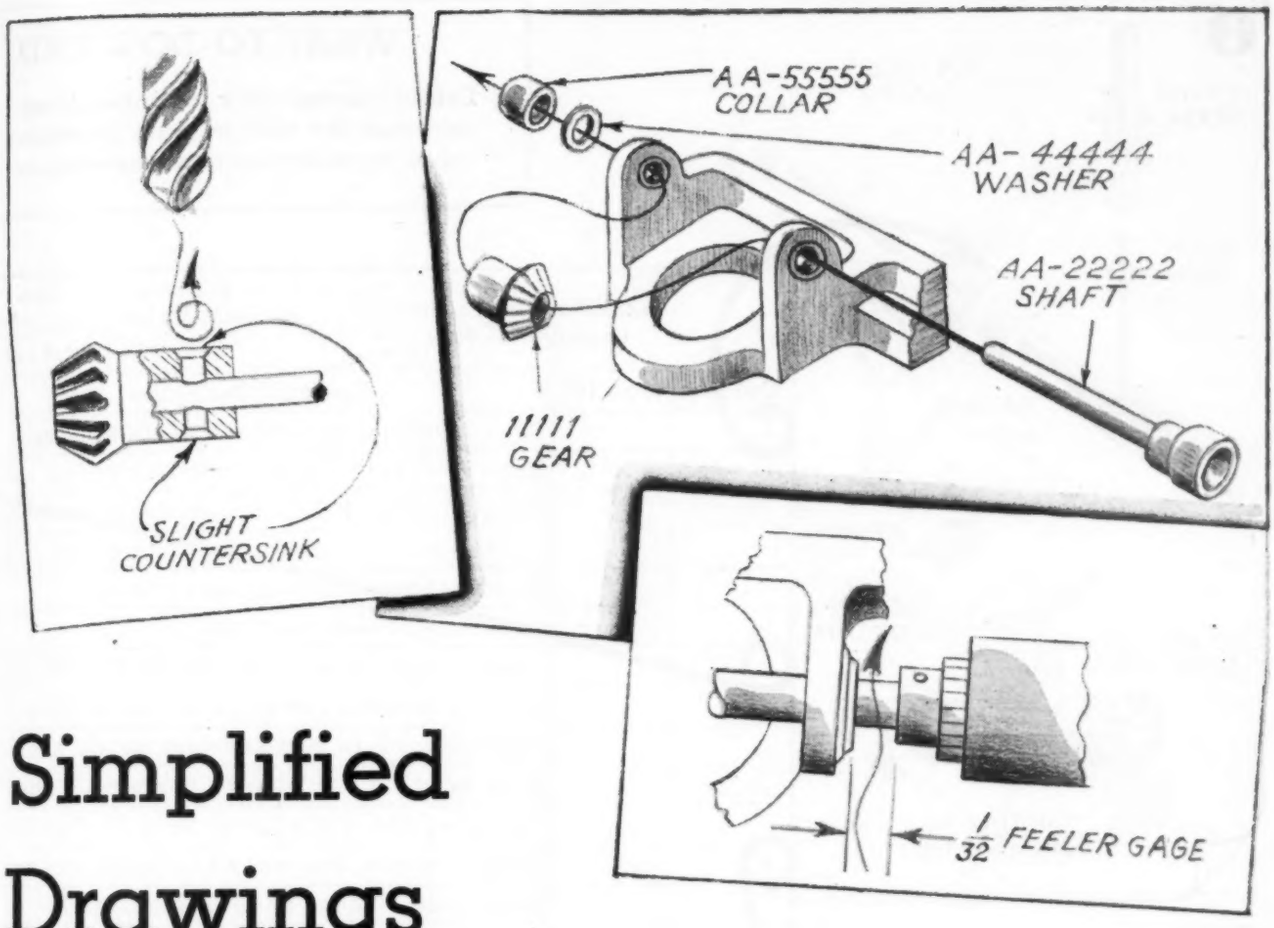
1. The limits for each position and each production group are established on the basis of the past performances of *that* group, so that no group is ever faced with an impossible task. All the members are asked to do is to continue to do as well in the future as they have done in the past, and to improve if possible.

2. The system is based on the well-recognized axiom that uniformity is the keynote to quality. Points above the control limits indicate that a lack of uniformity has entered the process and that time may be profitably spent in searching out this lack of uniformity. Points below the control limits indicate that the process is changing for the better, and it is worth while to attempt to see if this change may be made a permanent part of the process, so that the average percent rejections may be improved.

3. If the process is in perfect control, statistics show that only about 3 times in 1000 will a point fall outside the control limits—i.e., give a false alarm by indicating that the process is out of control when it is actually in control. This means that there should be only approximately one false alarm of this nature per year.

IF YOUR COPY OF *FACTORY* IS LATE—

Be patient, please. The nation's transportation system is severely loaded. The delay may be unavoidable. Allow a few extra days before writing us. Both the publisher and Uncle Sam are doing everything they can to get your *Factory* to you on time



Simplified Drawings Cut Training Cost

NICHOLAS DE SANTIS, Engineer, Western Electric Company, Kearney, N. J.

JUST HOW DO I DO THE JOB? That is what every new or inexperienced worker wants to know. He gets the answer quickly and clearly in one Western Electric unit through the medium of a new teaching technique which is being tried out there, so far with great success.

Briefly, the method involves the use of simplified, undimensional drawings of a semi-free-hand nature which picture step by step, in almost animated style, each detail of operation. Each move is designated by means of arrows which flow along the course prescribed for both parts and tools.

Known at Western Electric as "Isart," these sketches combine the best features of isometric drawings, exploded views, and blueprints—but are far less costly to produce.

Unlike conventional mechanical drawings, this type of illustration recognizes no standard angle of projection, unless it be the angle of view that most effectively tells *how*. This angle may be 30 degrees, horizontal, skew, right side up, or upside down.

A LOW-COST PRODUCTION METHOD

Sample sketches are shown above. The exhibit on the following pages illustrates how the sketches are used to clarify each operation in a manufacturing layout. It is plain that the inexperienced worker can read the operation description, study the sketch, and end up with a clear understanding of *what* to do and *how* to do it.

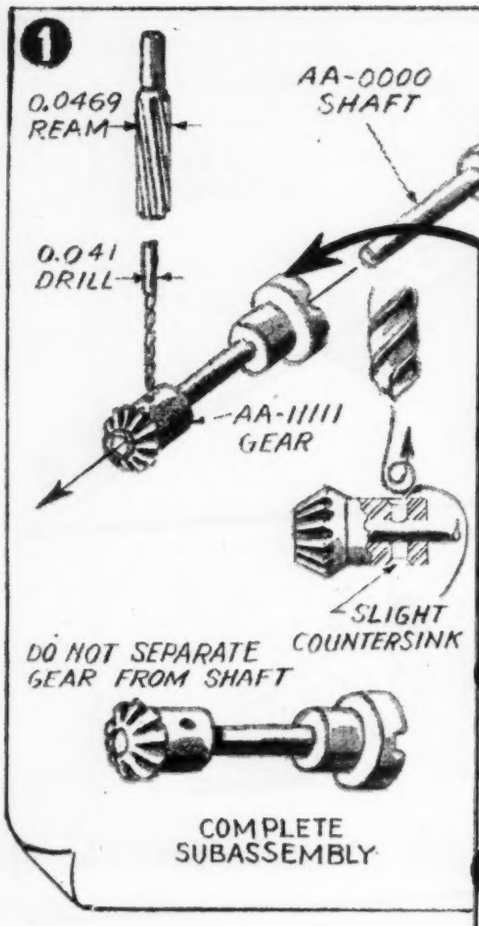
Operations for each operating position are shown on a separate sheet, corresponding to the division of text on the layout sheet. Multiple operations on one drawing would lead, obviously, to confusion. But the production of these drawings progresses so swiftly that their cost, either in time or money, cannot be reckoned in conventional drafting room terms. On a recent job, an artist turned out 54 drawings in a matter of 125 hours. If the isometric technique had been used, it is estimated that it would have required 450 hours to do the job.

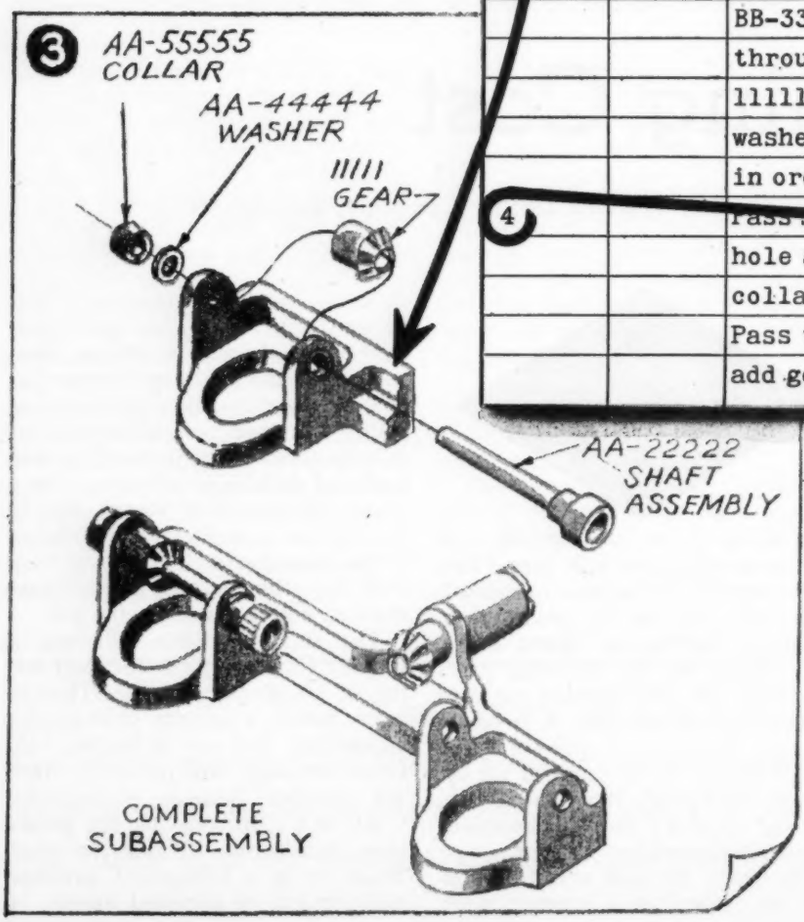
The reason for this difference is simple. Drawings made the Isart way require no laborious scaling. They require, rather, a definite photographic appearance, but use distortion, split views, shadings, and phantom effects not possible through photography.

An 8½ x 11-in. drawing has proved most satisfactory. Placed on cardboard, or in a transparent envelope, this size can be mounted handily on

WHAT TO DO – AND

Exhibit shows how undimensional drawings are tied in with operation sheets to teach inexperienced workers





Manufacturing Layout
Organization 9500

Replaces Issue Dated	Date
7-12-44	8- -44
	Sheet 1 of 3

Op'r. No.	Hrs. 100	Operation Description
1		Dept. 9840: Place shaft AA-00000 and
		gear AA-11111 in fixture and drill
		through with 0.041 drill and ream with
		0.0469 drill. Sink slightly on each side.
		Be sure that shaft and gear do not
		separate. Place in tray.
2		Remove gear from shaft AA-00000. Place
		spring AA-00001 over shaft AA-00000.
		Place shaft in top bearing hole. Add
		gear AA-11111. Place in fixture. Line
		up holes and pin with groove pin #4156.
3		Insert shaft assembly AA-22222 in left-
		hand side of gear mounting assembly
		BB-33333. Place shaft assembly AA-22222
		through first bearing hole and add gear
		11111 through second bearing hole and add
		washer AA-44444 and collar AA-55555
		in order mentioned.
4		Pass shaft BB-44444 through first bearing
		hole at right end. Add gear AA-11111,
		collar AA-55555, and washer BB-666666.
		Pass through second bearing hole and
		add gear AA-11111, spur gear AA-22223.

the bench. The artist quickly learns the comprehensible limits of magnification or reduction which can be employed safely to accommodate a given operation to this dimension.

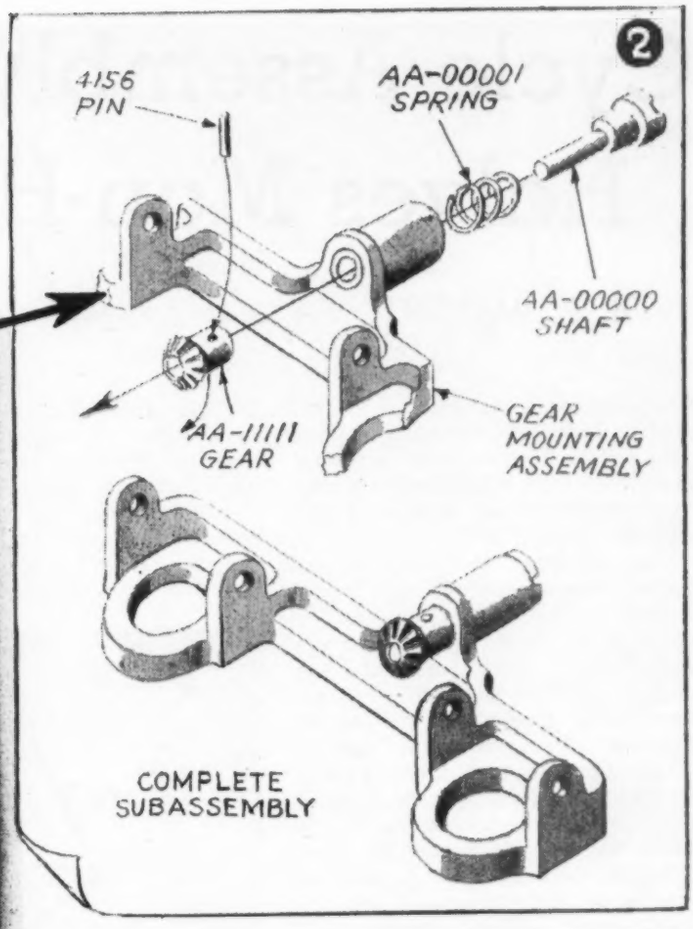
The new technique had barely made its debut on the shop scene when shop supervisors began requesting a full set of instruction drawings for starting assembly lines on new products. It means less time going through job routine with each new employee. One explanation usually suffices, and the drawing serves as a reference.

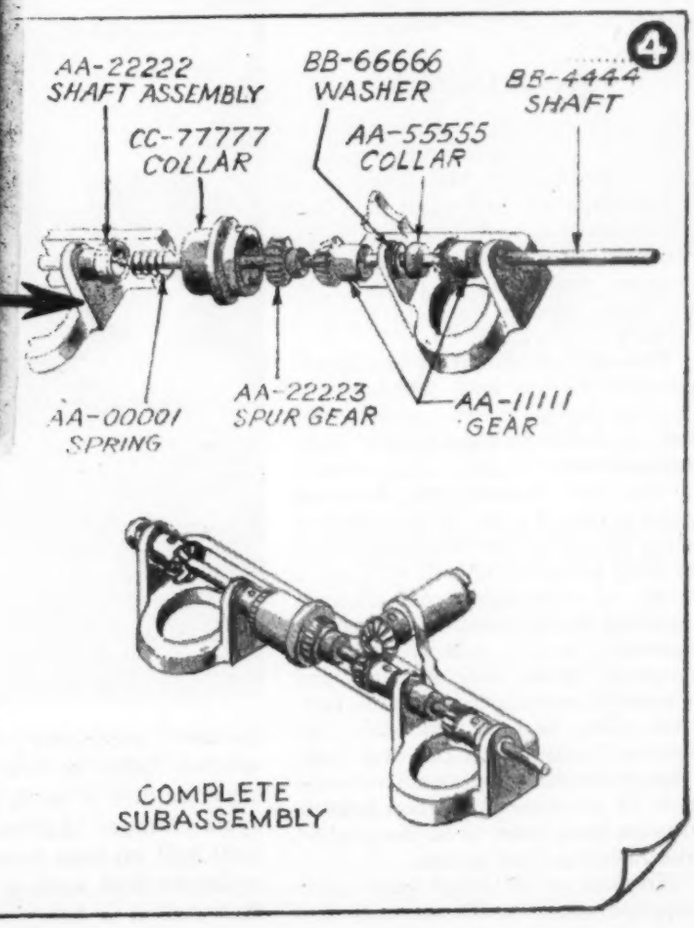
Whatever the future may hold for

HOW TO DO IT

how to do the job. Drawings are of the semi-free-hand type, picture each step in the operation, in almost animated style

Machine	Tool or Test Eqpt.	Labor Grade	Hourly Output
2 spindle drill press	Holding Fixture for drilling & reaming #31705 A 0.041 and 0.0469 drill		
#1 arbor press	Holding fixture to support gear while pinning #31705 R		
Bench			
Bench			





this method of instruction, it has shown three distinct advantages in its early trial runs:

1. Its cost in time and money falls far below that of isometrics, projections, and explosion photographs.

2. It places simple, non-technical "know-how" within easy reach of untrained workers.

3. Manufacturing engineers find the drawings most helpful as a rapid check on parts or assembly procedures without digging through layout sheets.

Cycle Assembly System Halves Man-Hours

R. P. WRIGHT, Chief Industrial Engineer, Edo Aircraft Corporation, College Point, N. Y.

CRITICAL AND URGENT NEED for immediate increased production of floats used on the Curtiss Scout Seaplanes presented a tremendous challenge both to management and workers at Edo Aircraft Corporation.

This challenge for increased production was successfully met by installation of the "cycle system," a combined project made possible through wholehearted cooperation on the part of the industrial engineering department which planned and laid out the program, the production division which supervises and directs production in accordance with the required deliveries, the tool engineering division which works with both production and industrial engineering on tooling improvement and betterment—and, it goes almost without saying, every worker on the assembly lines.

Space Limited

Preliminary analysis of the problem showed that the plant's ability to produce was limited by the manufacturing space and the equipment and manpower available. And these limitations precluded any possibility of expanding previous manufacturing processes to the degree required to meet scheduled delivery requirements.

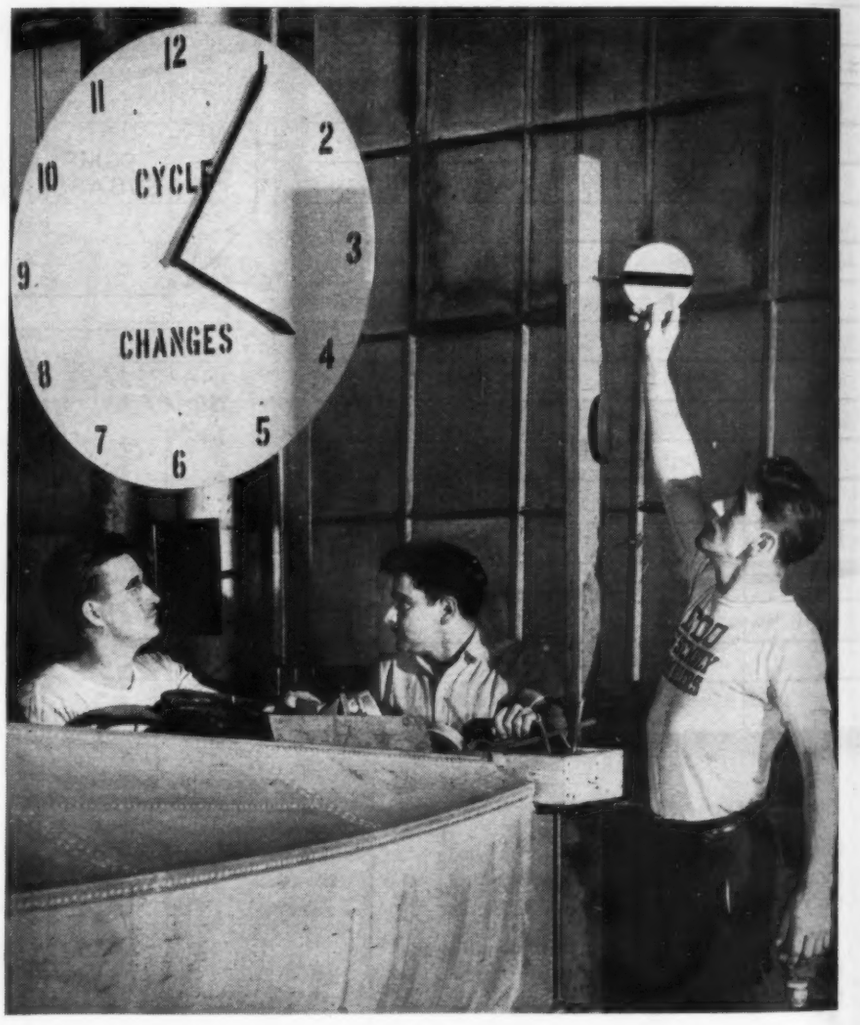
Previous manufacturing procedures provided for assembly (erection and decking) by unit crews working on an individual float in entirety as a single assembly unit.

The float structure may be compared to that of a ship. It has a keelson along the entire bottom supplemented by sister keelsons and is divided into a series of watertight compartments separated by bulkheads. The erection operation is the primary assembly operation of the basic structure and consists of assembly of bulkheads, keelsons, sister keelsons, and side and bottom sheets up to the deck rails. This operation is performed with the float in an inverted position because this has been found to be the quickest and easiest method to use.

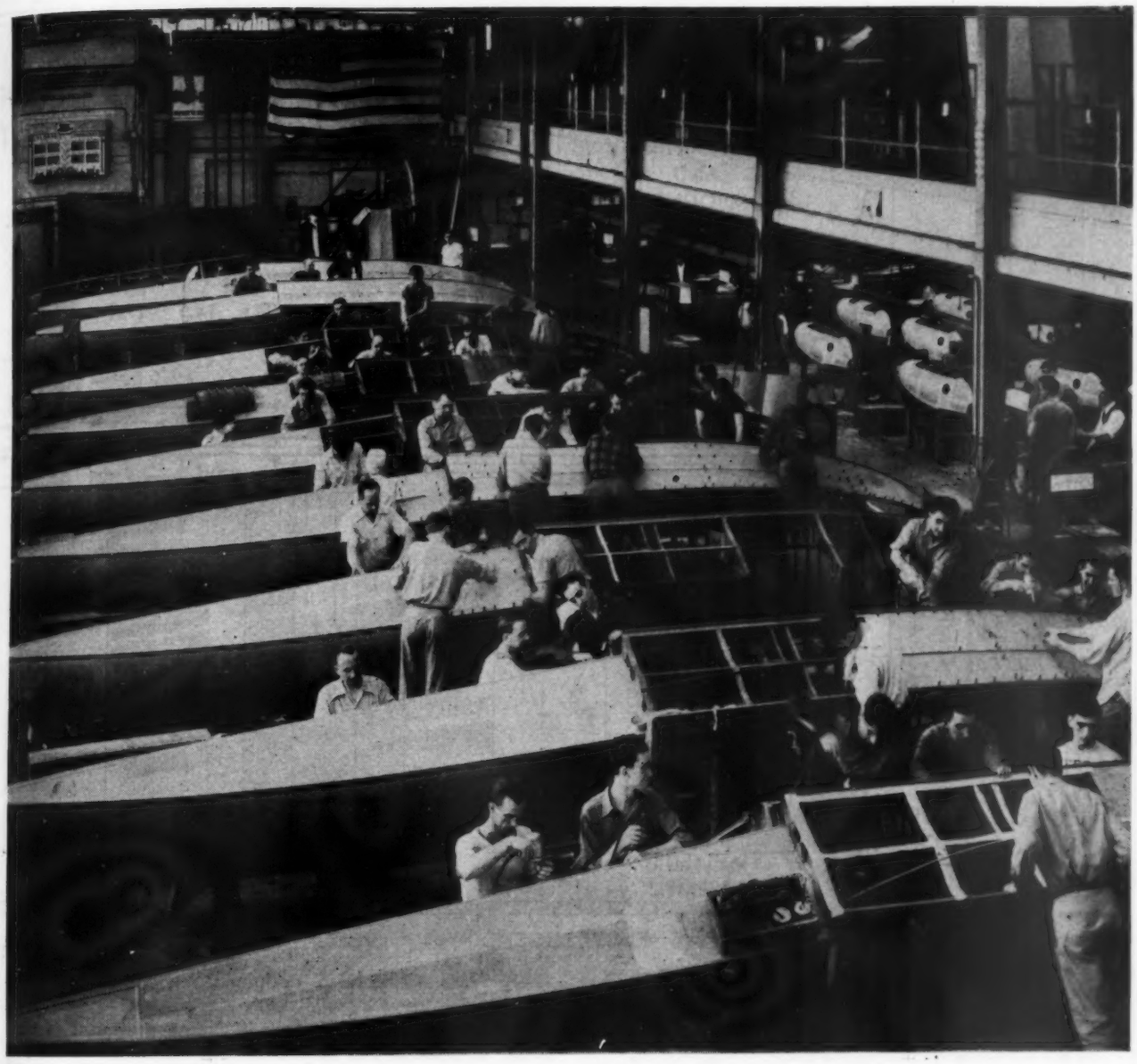
To make up for lack of space and to expedite assembly, the aft section of the float (from the stepback to the stern) is erected on a separate jig and is spliced to the forward section during the erection operation.

The decking operation includes assembly of deck sheets, pedestal structure, and all final finishing operations. For this operation, the float is removed from the primary assembly (erection) jigs, turned over to normal position, and placed on decking cradles.

Under these procedures, workers were trained so that they could work over the entire float area on all elements of erection or decking assembly work, because an entire float was



Leadman on primary assembly line where the basic float structure is erected, indicates that crew has finished its work on a float by inserting code disk at work station post. Clock shows scheduled time for the cycle change. Lighting system signals start of cycle, shows warning light half an hour before the end of the cycle. Red work station light indicates that work is not completed on the cycle schedule and that that station is delaying the entire cycle



Primary line for erection of structure and attachment of bottom sheets. Ideal way to build floats, Edo believes, would be on a paced line conveyor. Lack of space prevented. Since product could not be moved, the company decided to move manpower. Completed units are removed by crane to hatchway at end of line (see floor plan next page), then hoisted to decking lines on second floor

erected by one crew, on one jig, then moved to the decking department where the final assembly was done also on one jig. The number of men required for each jig unit on the old procedure varied according to type of float, running from as few as 5 to as many as 25 in some instances.

Long Training Needed

Such procedure required intensive education and training of labor because all workers had to be generally familiar with all the operation details involved in these assemblies. Under this plan each group produced a float from each jig in varying periods of time. Production requirements could not be met with the jigs and manpower available.

In the past this method provided scheduled deliveries of Edo's products. Under present-day operating conditions, however, inability to obtain skilled or even properly adaptable workers raised an unsurmountable barrier to further progress along those lines—and larger numbers of jigs or working stations were needed than space permitted.

Recognition of these conditions furnished the starting base point for development of a production formula that would provide:

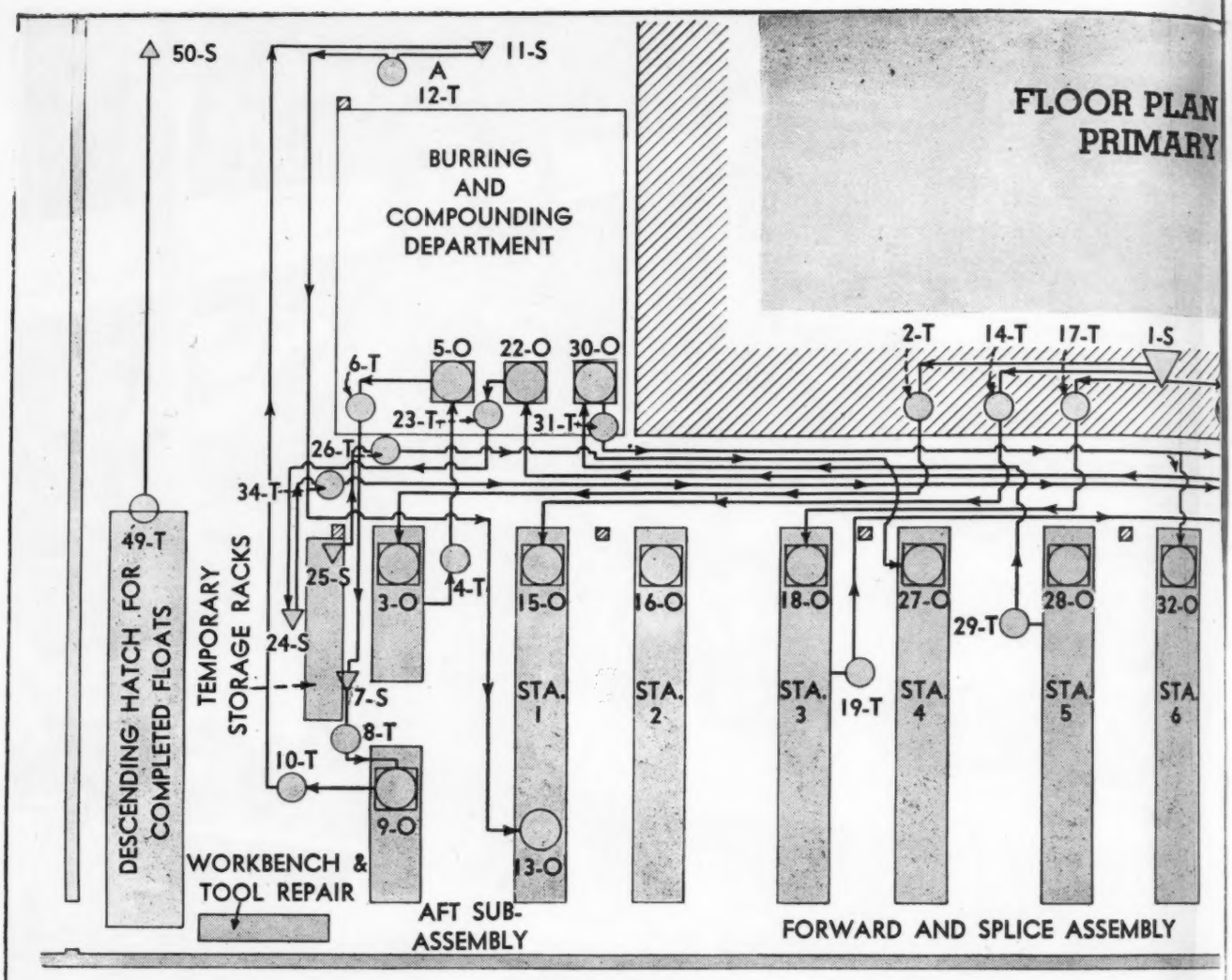
1. Use of less manpower working in limited areas (work stations) with limited task allocations.

2. Proper equipment to fit the limited space available for these station work allocations.

3. Application of (1) and (2) to provide delivery of floats at specified cycle times.

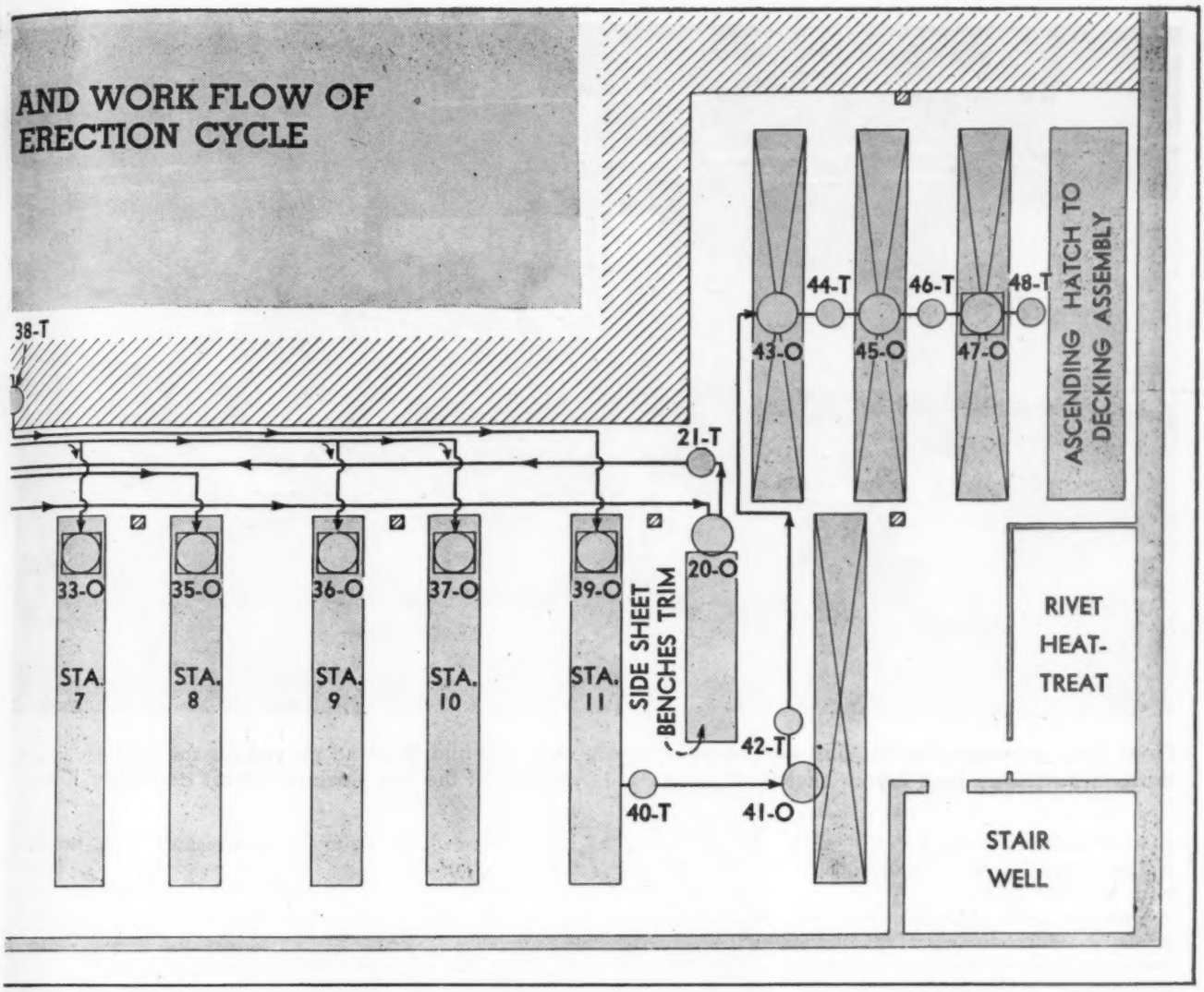
The industrial engineering standards-methods staff developed the float erection and docking assembly operations, and then set standard times for each. This analysis was then broken down to cover all assembly operations from the simplest to the most complicated, *but all in sequence.*

For example, the first operation was, of course, erection of the basic structure itself. Operation 2 added the next sequence and so on to the com-



FLOW LEGEND

1-S	Parts storeroom on mezzanine
2-T	Transport parts to aft subassembly
3-O	Work station No. 1 – aft subassembly
4-T	Transport drilled details to compounding
5-O	Compound and inspect details
6-T	Transport details to temporary storage
7-S	Temporary storage racks
8-T	Transport details to work station No. 2 aft
9-O	Work station No. 2 – aft subassembly
10-T	Transport aft assembly to temporary storage
11-S	Temporary storage for aft assemblies
12-T	Transport aft assembly to forward jig
13-O	Install aft assembly to splice with forward
14-T	Transport forward parts to station No. 1
15-O	Work station No. 1 – forward assembly
16-O	Work station No. 2 – forward assembly
17-T	Transport side details to station No. 3
18-O	Work station No. 3
19-T	Transport side details to trim benches
20-O	Trim and counterbore details
21-T	Transport side details to compounding
22-O	Compound and inspect side details
23-T	Transport side details to temporary storage
24-S	Temporary storage of side details
25-S	Temporary storage of bottom details
26-T	Transport bottom details to station No. 4
27-O	Work station No. 4—preliminary work on bottom details
28-O	Work station No. 5—additional work on bottom details
29-T	Transport bottom details to compounding
30-O	Compound and inspect bottom details
31-T	Transport bottom details to stations 6, 7, 9, 10
32-O	Work station No. 6—rivet part of bottom details
33-O	Work station No. 7—rivet part of bottom details
34-T	Transport side details to station No. 8
35-O	Work station No. 8—rivet partial side details
36-O	Work station No. 9—rivet partial bottom and complete side
37-O	Work station No. 10—rivet complete bottom
38-T	Transport parts to work station No. 11
39-O	Work station No. 11
40-T	Transport complete assembly to erection finish
41-O	Erection finishing operations
42-T	Transport assembly on dolly to additional finishing operation
43-O	Additional erection finishing operation
44-T	Transport assembly to additional finishing operation
45-O	Additional finishing operations
46-T	Transport assembly to additional finishing operation
47-O	Additional finishing operation
48-T	Transport by lift to decking assembly
49-T	Transport from deck assembly
50-S	Temporary storage for completed assembly



There is one one cycle line with eleven work stations for primary erection. Final assembly, on the other hand, requires two cycle lines of seventeen stations. The unified production of these three units is coordinated to provide delivery of a float from the erection line to the decking assembly in "offbeat" schedule. Cycle operation has halved man-hour cost. Output has been increased five times

pleting work. These operations were first laid out, broken down by sequence into work stations for manpower allocation to each work station so that the entire cycle line would complete the allotted task in unison on a specific scheduled time.

Manpower Specified

These operation sheets specified the manpower required for each station, and, because each work station operation was limited, lack of labor experience could be corrected by a short training period instead of the previous long time required for overall float training. As a matter of fact, actual experience proved that workers learned this work much quicker than was originally expected; also it has been possible to promote workers from the simpler tasks to the more complicated tasks much quicker and with much better results because their training background fits them for such promotion more quickly than before.

The ideal way of producing floats on a cycle system would be on a paced line conveyor system. Unfortunately, however, lack of space prevented, and it was decided that, if material could not be moved, manpower would.

The preliminary work sequence allocation was next reduced to a series of operations sheets covering each sequential work station, and this work allocation was applied to a floor layout plan specifying work stations with jigs, cradles, or other needed equipment for each station.

Naturally, the actual man-hour total for these several stations required variable amounts of man-hour labor input. This total labor-hour input was then reduced to the unit cycle time by the assignment of proper manpower required at each station to complete the assigned task within the scheduled cycle or elapsed hourly time.

In other words, a schedule to produce two floats in a 9-hour day would require two cycles of 4½ hours each; three would require three 3-hour cycles; and six floats would require six 1½-hour cycle delivery times.

Work Complicated

Much float work is extremely exacting and complicated, and has to be performed in small, difficult working areas so that labor-hour volume is not alone a measure of work station assignment. Because of this fact some work stations may be assigned only two skilled and qualified workers while other stations may be assigned four to eight workers because the particular

Float from primary erection line has been hoisted through hatchway (see layout sketch on pages 126 and 127) and is being placed for the first operation on one of the two decking (final) assembly lines

type of work performed there is simpler and permits assignment of workers over an entire float area.

Shown herewith is the floor plan for primary erection. It will be noted that there is only one cycle line with eleven work stations. Final assembly, on the other hand, requires two cycle lines of seventeen stations.

The unified production of these three units is coordinated to provide delivery of a float from the erection line to the decking assembly in "off-beat" schedule. This "off-beat" schedule provides an erection cycle of *X* hours, a decking cycle of 2*X* or *Y* hours, spaced so that one assembly line is ready for an erected float every *X* hours delivered alternately to each cycle line on its *Y*-hour cycle. This cycle operation produces a float from each decking line every *Y* hours alternately, or one completed float every *X* hours.

Cycle operation has accomplished several important results. First of all, it has cut man-hour cost more than one-half. Output has been increased more than five times.

There is wholesome rivalry between lines and departments because, while the cycle time specifies the elapsed or scheduled time, bonus earnings are based on the labor-hour input, and the reduction or addition of manpower to these lines consequently affects wage incentive or bonus earnings.

Workers Critical

Under these conditions the workers themselves are extremely critical of non-producers. They are always eager and anxious to help on work stations other than their own where assistance is required to meet cycle time because delayed cycles require overtime which, of course, adds to the actual labor hours charged against their standard hour rate. For example, a 2-hour cycle with 50 men provides 100 man-hours input against the standard hour rate, but, if the manpower element remains the same (50 men) and 2½ hours are spent on the cycle, there will be 125 actual man-hours spent instead of 100.

The cycle line is being extended to other assembly operations as the industrial engineering department and production management determine further fitting work assignments. This is not a simple problem, because first of all there must be a sufficient volume of labor hours and work allocation to warrant breaking down operations into cyclical stations, and, second, scheduled requirements must be of a volume that warrants setting up cycle arrangements. Where the total production volume is limited, ordinary assembly methods have been found preferable.

EVERY MONTH, AMONG THE ADVERTISING PAGES, these valuable aids to low-cost production: the plant operation man's guide to WHAT'S NEW in EQUIPMENT (page 168) . . . a summary of LABOR DEVELOPMENTS (page 220) . . . things YOU WANT TO KNOW more about (page 208)

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

Quiz show winner at General Box Company's first presentation of its "Traveling Show," which promotes a feeling of security by telling workers what the company is planning in the way of new products.

Post-War Plans Revealed to Workers

One of the surest ways to keep workers productive is to allay their fears of the future. A feeling of insecurity not only distracts their minds from the job in hand and makes them produce less than their best, it also is likely to induce them to look for another job, one that they think may promise more stable employment.

It was to offset this feeling of insecurity that General Box Company started its traveling show.

It all began at a sales meeting late in 1944. A program was conducted with exhibits of various products, and speeches by top executives. A glance into the future was given to the sales force. A chance remark, a wish that this show could be viewed by every employee, was made.

As a result, in February, 1945, printed invitations were sent to employees of the Detroit branch. In part the notice read, "You are cordially invited to be present at the Traveling Show of our post-war products." The words "post-war" insured a large turnout.

The show itself featured a line of the company's wartime products, and models of products that will be produced at the war's end. Then there was entertainment, a quiz show, and prize money awarded to winners. Of course there were speeches —but the speeches had been carefully prepared. They were not dull and long-winded. Rather they were panel discussions. Workers were told about the scope of the company's activities, the company's growth, and plans for expansion were outlined. They liked that, it made them realize that they were part of the company. Then they were let in on a few secrets—new products that would be manufactured in the days of peace.

What were the results? And was it worth the cost? Perhaps no immediate upturn could be seen in production charts, but the results could be foretold from the faces of those who attended, the pride, satisfaction and security that comes from feeling that they were partners in what the company could and would do.

In any event, General Box felt that the results from this experimental meeting were good enough to carry the show on to all its plants, so that everyone in the company could know that he has an important role to play in the post-war world.

•

Individual Work Booths Step Up Production

JAMES CLYDE PORTER, Hutchinson, Kan.

A way to discourage unnecessary and time-wasting conversation has been tried out and found successful by A. D. Raylo Motor Company, Hutchinson, Kan.

This company has built individual three-sided work booths for small assembly and disassembly operations. The sides of the booths are half again as high as the height of the average operator, and are fitted with shelves and small compartments so that everything needed for the work is at hand. A small fan that can be switched on or off at will also is installed in each booth. When the operator is in a booth there is nothing to distract his attention, and it is impossible for him to talk with anyone, even in the next booth, without raising his voice well above the normal pitch.

The use of these individual booths boosted production 30 percent.

•

Employees' Club Fosters "Presenteeism"

P. D. KEATING, Naugatuck, Conn.

To curb absenteeism, and to build up the war worker's morale, Scovill Manufacturing Company, Waterbury, Conn., through its War Production Board, has founded an organization known as the "Veterans of War Production." To be eligible, a Scovill employee must have worked continuously in the plant during the last six months of 1944 or the first 6 months of 1945. Members to be certified to this organization will wear lapel badges. Disks will be added to the badges for employees who have worked steadily as far back as

Storage racks are built on two sides of a center well, so that crane can pick up or set down blade rings on roller-mounted trays. Floor space occupied by racks is 15 percent of their total set-down capacity

Lift truck, operated by a woman, increases warehouse space 25 percent by stacking bales of fabric almost to the ceiling

1941—one disk for each year of service in the company.

Employees are well pleased with the club, and are striving to better their records so that they may wear the badges. Indirectly, the organization shows up slackers. Naturally, they will not be able to wear badges until their records warrant them.

It has been felt that war workers are not receiving enough credit for being on the job day in and day out. That their service should be recognized is also the opinion of Washington officials who are giving the Scovill plan national attention.

•

Storage Racks Save Floor Space

G. H. FETTERS, Merchant Marine Division, Westinghouse Electric Corporation, South Philadelphia

When additional machine tools and equipment were acquired to meet increased production schedules, the layout changes resulted in larger machining and assembly areas, with less floor space for storage.

To allow for the additional production space, it was necessary to reduce the area used for the set-down of work in process. This reduction was made possible by building racks for blade rings such as the one shown in the photograph at the left (top).

Each of these racks, which are of welded construction, has 36 roller-mounted trays arranged in four tiers of nine trays each; the four stationary trays on top of each tier give the racks a capacity of 40 blade rings.

Racks are designed so that two tiers of trays are located at opposite sides of a center well into which the trays are rolled for loading and unloading. When a tray is located in the center well a crane is lowered to pick up or set down a unit.

The floor space occupied by the new racks is 15 percent of their total set-down capacity—which means a large saving of needed floor space.

•

Handling Problems Solved by Lift Truck

SOURCE: Towmotor Corporation, Cleveland

When The Pond Lily Company, Hartford, Conn., found itself faced with pressing storage, handling, and manpower problems created by the armed forces' demand for a speed-up in deliveries, it purchased a lift truck.

The immediate effect was a 25 percent increase in warehouse capacity. Rolls weighing 580 pounds, as well as heavy bales and boxes, are tiered on dunnage blocks. Rolls are piled three high, to a height of 13 feet.

Loading and unloading of trucks backed up at the loading platform has been speeded up. The lift truck, operated by a woman, does the work of a gang of hand truckers.

MAINTENANCE SERVICES

The well-maintained plant is the high-production plant

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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MAINTENANCE as the Editors See It

Every Plant Can Afford These Aids to Production

OUTPUT of many new plants built to produce the implements and supplies of warfare has been considerably larger than had been expected when they were designed. A number of highly plausible reasons may be advanced in explanation of this fact.

For example, all these plants, or practically so, were designed with production requirements uppermost in mind. Production equipment was, with probably few exceptions, the best that could be had. The lighting is of a high order of excellence. Much attention was given to employee comfort and health. Hence good heating systems, proper ventilation, in numerous instances close control of temperature and humidity, are almost always to be found. And, of course, there have been effective training systems, incentive payments—in brief, everything that would help to increase personal efficiency and therefore output. Along with these features there has been intensive search for better ways of doing things.

Great wisdom, indeed, would be required to evaluate all these elements properly as to their effect on production. Collectively, they have made new production records possible.

Not every company is fortunate enough to have the advantages of a new plant built specifically to its needs, and equipped throughout with the latest designs of production machines. There are, however, several highly effective aids to low-cost production—high-quality lighting, adequate heating and ventilation, efficient layouts of machines and workplaces—that any plant can well afford.

In fact, no plant can afford to be without them.

Proper Records Help to Keep Maintenance Costs Down

THE CHIEF MAINTENANCE EXECUTIVE in a well-known plant is finding his carefully planned equipment record file of the utmost help these days. Much new equipment will be installed. No effort will be spared to cut production costs as much as can be done by the efficient use of good equipment and adequate facilities of every kind. Also, by good maintenance.

Inevitably a great many pieces of equipment have to be considered from the standpoint of whether they are worth keeping, in view of the maintenance attention needed and the cost of repairs over a period of years. The equipment record kept in this plant gives dollars-and-cents answers to such questions. Also, on the average length of life of different makes of belts, types of floor patching materials, and various other things.

Keeping accurate records of this sort obviously requires some clerical work, costs some money. Too, the clerical work involved is not confined to making entries on cards. There has to be, and is, business-like organization and operation of the maintenance department, proper allocation of charges, and an accurate record of the time spent on each job, with the kind, amounts, and cost of materials used. Nevertheless, the value of the information available from this equipment record greatly outweighs the cost.

Aside from the definite information that this record gives about equipment performance, it serves also as a valuable check on the methods and workmanship of the maintenance department. In a number of instances, high maintenance costs on a certain piece of equipment have been traced to poor or careless workmanship, or failure to get at the real cause of trouble.

An equipment record of this kind, if properly kept up and used, will help any plant to keep its maintenance costs down.

Match Motor Enclosures With the Operating Conditions

THERE WILL BE fewer open-type motors in use during the coming years, if the present intentions of many plant electrical men are carried out. These men frequently say that hereafter only motors with some form of enclosure will be installed in their plants.

Presumably this does not mean that open motors are immediately going to be put in a glass case along with the dodo and other relics of the past. There are many applications in which this type serves substantially as well as any other would. Nevertheless, both users and designers have recognized for a long time the need for better protection against the entrance of liquids, dirt, and foreign objects.

Recognition of this need has been translated into the development of a number of different types, or degrees, of enclosure. These enclosures range all the way from simple provisions for keeping falling liquids or objects out of a motor to the well-known full enclosure. Within this range there may be found a type of enclosure that will give adequate protection against any conditions to which a motor is likely to be subjected.

It is easy enough to go all out and install fully enclosed motors everywhere, as some plant men have threatened to do. And no harm would be done, except to increase capital investment unduly.

A more conservative and less costly course involves an accurate appraisal of the operating conditions and exposures, and the selection of the kind of enclosure that will give suitable protection at minimum cost.

Production Methods Applied to Plant Maintenance

R. F. BARTLETT, Chief Industrial Engineer, Victor Adding Machine Company, Chicago

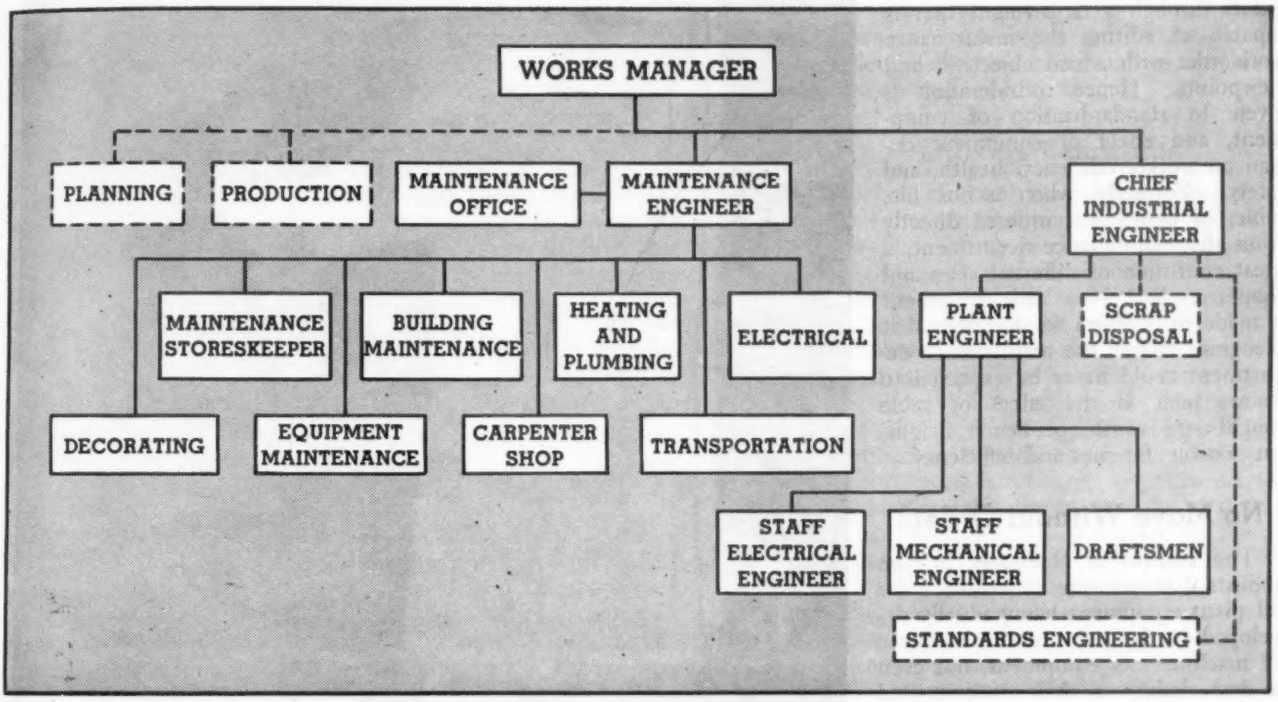


Figure 1. By this organizational set-up, all maintenance is planned by the industrial engineering department, which tells the maintenance department what to do and how to do it

ALL REQUESTS FOR maintenance work in the Chicago plant of Victor Adding Machine Company are routed through its industrial engineering department. This department, in turn, issues all orders to the maintenance department, telling exactly how that work is to be done.

The plan, in brief, is based primarily on a recognition of the fundamental values of division of work between thinkers and doers. As a result, the maintenance department of about 50 employees operates under "production" orders practically the same as the manufacturing departments, except that its "product" is maintenance. So complete is the cooperation with the industrial engineering department that a maintenance worker would no more think of changing specifications on his maintenance order than would a production worker.

The advantages of this plan have been numerous, and will become self-evident as the succeeding narrative tells how it operates. From an overall viewpoint it has been roughly estimated that the proper employment of highest skills has resulted in (1) saving one-third of available productive maintenance time; (2) increasing by one-half worker efficiency in the maintenance department.

A TECHNIQUE FOR PEACETIME PRODUCTION

Organizational set-up probably has as much if not more to do with the attainment of these benefits as anything else. The basic scheme of organization is that productive functions of maintenance are supervised by a maintenance engineer, while the planning is done by a plant engineer.

From the abbreviated chart (Figure 1) it will be seen that the maintenance engineer reports directly to the works manager and has a responsibility parallel to the production heads. Under the maintenance engineer are the foremen of the various maintenance divisions that specialize in "production" of plumbing, decorating, carpentry, electrical work, building and equipment maintenance, and janitorial work. The plant engineer, however, reports to the chief industrial engineer, who has a staff advisory relationship to the works manager. He is assisted by an electrical and a mechanical staff specialist, and by clerical workers. To him come all the engineering problems in the plant, whether of a production or maintenance nature, except product design.

What are the advantages derived from this arrangement? In the first

place, the maintenance engineer no longer spends any part of his time figuring out what to do and when to do it. These details are already part of the instructions given him by the industrial engineering department. He therefore confines his efforts solely to directing how the mechanical skills of his department are to be applied to obtain the most efficient performance of the work requested.

Another advantage is obtained by the clearance of all maintenance requests through a department that is capable of editing the maintenance work-order with added objectives and viewpoints. Hence consideration is given to standardization of equipment, and effect of equipment design on worker efficiency, health, and safety. Formerly, when a box file, table, or bench was ordered directly from the maintenance department, a great confusion of different sizes and shapes resulted. Now such equipment is made to conform to standards that recognize factors the maintenance department could never be expected to know, such as the effect of table height and width, or bench height, on worker fatigue and efficiency.

No Move Without Orders

The control of standards by the industrial engineering department for all plant equipment has gradually developed to the point where no piece of machinery or equipment, not even a desk, lamp, or chair, is permitted to be moved without an order from this department. The explanation for this rigid rule lies in the fact that lighting of the entire plant, except the executive offices, has been engineered to have all seating face north and east. Personal whims of workers and supervisors therefore must yield to the discretion of men who know what is really best for them.

Second only to the organizational set-up in obtaining greater efficiency in the maintenance department is the care with which the industrial engineering department issues its orders for all maintenance work. Orders are never just of the general "fix-it" type, but always of the specific "do-so-and-so" type that require no deliberation by the maintenance department as to exactly what is wanted. In outline the instructions on each order are similar to an operational sheet for a production worker.

A typical maintenance order reads: "One 6-in. by 8-ft. I-beam will be delivered to your department. Replace present 5-ft. extension on track hoist on the shipping platform with the 8-ft. beam. This beam has enough strength for the 3-ft. overhang so that all the old mountings in their original location may be used. Extend hoist track to the end of beam and put end-stop for hoist. Replace present anchors where concrete has loosened."

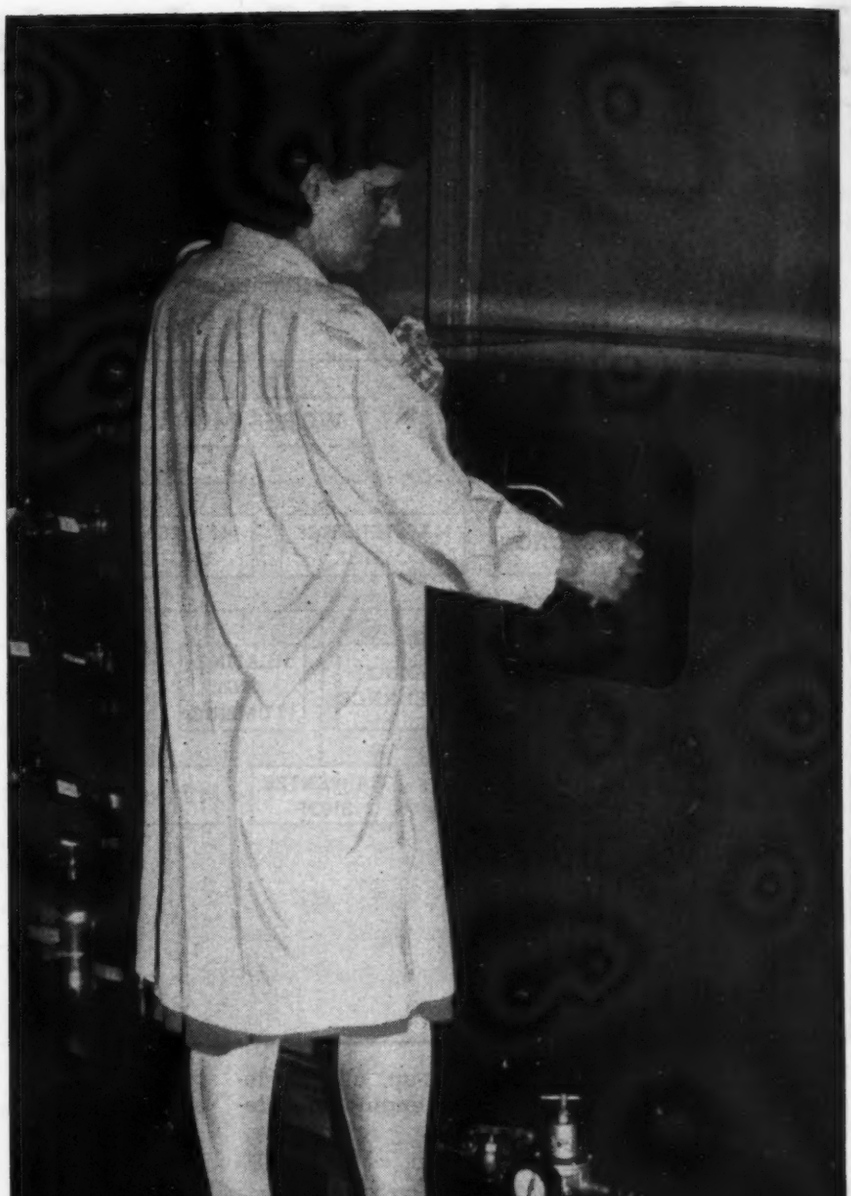


Figure 2. All requests for maintenance work are analyzed by the industrial engineering department from many angles. In response to a request for a compressed air line to clean small parts, a booth was designed for safety, cleanliness, and work simplification

Obviously, detailed instructions like these do not require any further planning by the maintenance department, and enable it to concentrate on getting the job properly done.

The wording of an order by the industrial engineering department is always the result of a well-defined preliminary procedure. A request for the repair of equipment of even the smallest significance causes the industrial engineering department always to ask itself what caused the breakdown. The result is frequently an order very differently written from the way it would have read without this information. For instance, a supervisor wanted a broken bracket

repaired. Under ordinary circumstances, no hesitation would be felt in making this simple repair. But in this instance the industrial engineering department, by first investigating the cause for repair, ascertained that the bracket did not belong there in the first place, and that it should be replaced by other equipment.

Careful Diagnoses

In another instance, the electroplating department complained of poor operation of the ventilating system, saying obnoxious fumes were not being entirely removed. An order was given to the maintenance department to make complete tests on the motor-fan unit. The report came back that electrical tests and r.p.m. count showed everything in working order, and it recommended a supplementary system. In line with its policy, however, the industrial engineering department set out to satisfy itself that the existing unit was inadequate, and discovered that the exhaust louvers on the roof did not open because the hardware cloth inside was badly clogged with dirt.

These are just two of many instances that have proved the value of making a careful diagnosis of the trouble before accepting the need for repairs at face value. This is not possible with most conventional maintenance organizations.

Another rule of the industrial engineering department, when translating maintenance requests into orders, is to plan for possible future needs as well as for present requirements. A case in point is the air-booth (Figure 2) now in use in many parts of the plant for cleaning small parts with compressed air, prior to assembly. This booth originated from a simple request for an air line in one department to be used in occasional work of this kind. Ordinarily, a compressed air line would have been run to the location requested, and a flexible hose outlet hung there on a hook, which would have satisfied the request. Instead, a booth was specially designed with a foot-operated valve to permit easier handling of the part, and with a glass enclosure for safety and cleanliness. Moreover it was functionally located adjacent to a storage bin.

When similar requests for compressed air outlets were repeated, the original booth became the standardized answer.

Obviously, the successful application of industrial engineering principles to maintenance work requires that no work shall be done by the maintenance department without an order from the industrial engineering department. And because the maintenance department now receives its orders from only one source, and because operating personnel have learned to discuss all maintenance problems with the industrial engineering department, the maintenance engineer is left free of harassment.

Up to this point no description of the order forms used in this plant has been given, because aside from their function of providing the paperwork for control of maintenance work by the industrial engineering department, their design is not particularly important to the success of the plan. To provide for the desired control, three types of maintenance orders are required. For maintenance work not of a repetitive nature, involving specific repair or construction work, there are two forms whose difference is only that one is for work costing under $15, and the other for over $15. The first requires approval only by the chief industrial engineer; the second must be approved also by the works manager.

"Schedule" Orders

A third type of order, known as a "maintenance schedule," is in effect a blanket order designed to eliminate the need for repeated issuance of the other two types of orders where it is known that a maintenance job must be done at regular intervals. By use of this schedule, preventive maintenance duties have been efficiently laid out for each year on a weekly or monthly basis, as may be required. Separate schedules call for checking, cleaning, or overhauling of plant service equipment such as ventilating systems, heating, and lighting. Similar schedules have been drawn up for motors, machinery and equipment, and painting. Special instructions for the methods to be used in all preventive maintenance work are determined by the manufacturers' recommendations and analysis of the requirements by the plant engineer and maintenance engineer.

Only one exception exists to the established rule that the maintenance department must have a written order from the industrial engineering department before doing any work. In an emergency, the maintenance engineer may proceed at once with the repair, but even then the industrial engineering department is called in as soon as possible for consultation as to the methods used and the extent to which the repair should be made. Money is frequently saved because the industrial engineering is planning replacement, and therefore orders only stopgap repairs.

All maintenance orders are issued in triplicate. The original goes to the maintenance engineer, and one copy to the cost department. The third copy remains in a file in the industrial engineering department for purposes of control and follow-up. When the job is completed, the original order is returned to the industrial engineering department, which investigates to see if the job has been completed to its satisfaction before checking the order as completed.

Outside Contracts

Not all plant maintenance work is assigned to the maintenance department. Where work such as outside painting or roof repair can be done better and cheaper by outside specialists, the industrial engineering department arranges for the contract and is entirely responsible for its execution. The noticeable tendency of this and other procedures is to utilize to the highest degree the respective skills of both departments, which is again the application of the basic principle that is the key to the success of this plan.

For the same reason, the industrial engineering department assumes the responsibility for the progress of all work, and sets approximate schedules for completion. On all work requiring more than one week to complete, it maintains a "production-control" board that is brought up to date weekly from reports of the plant engineer and its own two staff engineers. Active orders not large enough to appear on the control board are reviewed in the files weekly, and a list of the ten most important outstanding orders is issued to the maintenance engineer.

The progress of annual maintenance schedules is checked by the staff engineers, both by actual inspection of the completed work, and by review of summarized weekly time-charge reports. Any jobs that are lagging too far behind are referred to the works manager for whatever action he considers necessary.

In summary, all relationships established between the maintenance and industrial engineering departments for the "production" of plant maintenance closely resemble those in acknowledged good production practice. That this plan has led similarly to high worker efficiency and lowered maintenance costs is therefore an understandable corollary.

Service Methods That Cut Fluorescent Lighting Costs

JOSEPH W. ST. ANDRE, General Maintenance Supervisor, Wright Aeronautical Corporation, Wood-Ridge, N. J.

BECAUSE the Wood-Ridge plant of the Wright Aeronautical Corporation, builders of the 18-cylinder Cyclone engines powering the B-29 Super-Fortresses, was built to requirements of a totally blacked-out war plant, it presented a formidable problem in plant lighting maintenance. Built without windows, the main manufacturing building has to be artificially illuminated 24 hours a day, 7 days a week, by more than 13,000 fluorescent lighting fixtures.

The building, a flat-roofed structure, is made up of 20x38-ft. bays, each lighted by six fluorescent luminaires suspended from the ceiling. Each luminaire contains two 100-watt fluorescent lamps, 18 feet above the floor. In addition to the general overhead lighting, another 1000 fixtures are located on inspection and workbenches where high-intensity lighting is required. Since most of the bays have aisles running on the sides of the 38-ft. spans, and conveyors run between two rows of machines (some machines are 15 feet high), it is apparent that lighting maintenance is a real problem. To complicate the problem further, most bays have a system of traveling cranes, two cranes stretching across each bay. Each crane system is suspended from its own superstructure because there are no steel members in the building itself from which to suspend crane rails.

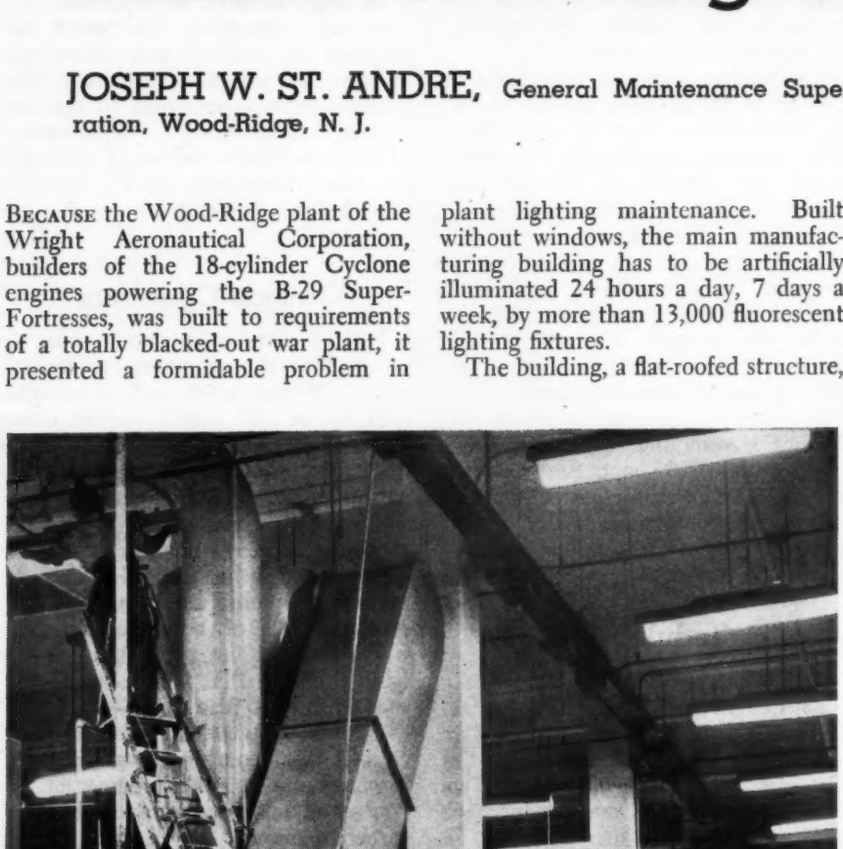


Figure 1. Cleaning fluorescent fixtures and replacing lamps at the same time is done by a three-man crew, using an aerial ladder, which enables them to get to hard-to-reach luminaires

Two Distinct Problems

Given the task of maintaining this lighting system, two distinct problems became apparent to the electrical department. First, in order to service the lamps, some device had to be obtained to get at the fixtures themselves, located as they frequently are in a maze of conduits, ductwork, crane rails, conveyors, and other machinery. Second, what service program should be set up?

The first problem was that of getting at the lamps. This same problem was found to exist in the company's Lockland, Ohio, plant where the main manufacturing building is similarly laid out. At Lockland, the problem was solved by the use of a revolving aerial extension ladder, with a platform on the upper end and its base

mounted on a standard automobile truck chassis, similar to the equipment used by public utilities in maintaining street lighting. But although this equipment works well in the Lockland plant, where the aisles are wide, the 7-ft. aisles at Wood-Ridge ruled out this type of equipment because it could not be maneuvered.

Nevertheless, this method was apparently the right answer to reaching the fixtures, because it enabled the lamp crew to work up and over machines without interfering with operations beneath. It also enabled the servicing of fixtures over areas forbidding the use of stepladders because large machines, conveyors, and the like were in the way. Another feature favoring the equipment was the safety of the lamp cleaner, who had a platform on which to work. On each side of the platform there was a ring bolt for hooking the worker's safety belt, thus leaving him free to use both hands.

Aerial Ladder Used

At Wood-Ridge, therefore, the solution of the problem of reaching the lamps lay in mounting this aerial ladder on a small truck or skid, that could navigate in the narrow aisles and still be able to support and balance the ladder with a workman on it when reaching halfway across the 38-ft. bay. The ladder also had to reach up 14 feet in the air in order to service the middle luminaire in the bay. This range was obtained by mounting the ladder on a block of concrete and steel placed on a heavy 4-ft. platform caster truck (Figure 1). The ladder was counterbalanced by steel weights so that an effort of 25 pounds will raise and lower it through its vertical range of 60 degrees. In addition, the ladder can be swung horizontally through 360 degrees.

Although this arrangement was found to be ideal for replacement of lamps over obstructions, the device is somewhat clumsy and not easy to handle. There are many aisles in the plant where no interference is encountered, so that it is uneconomical to use this type of ladder in such locations. For this purpose a light telescopic platform ladder was found, which is easy to move about and yet provides a safe platform from which to work (Figure 2).

Figure 2. Overhead lighting maintenance costs are lower in the aisles and open areas where fluorescent luminaires can be serviced easily and safely by using a telescopic platform ladder

FOR LOW-COST PEACETIME OPERATION

Once the equipment for reaching the lamps had been obtained, the electrical department turned its attention to the second problem, that of determining the service program for the lamps and fixtures.

There are many factors that introduce themselves into a lighting maintenance program. Following are a few of the most important:

1. Lighting installation itself (types of fixtures, height from floor).
2. Accessibility of fixtures.
3. Type of equipment on the floor.
4. Obstructions over machines (air lines, conduits, ductwork, cranes, etc.).
5. Layout of aisles used by service equipment.
6. Atmospheric conditions (oil, dust, mist).
7. Ventilation systems (type of air circulation around luminaires).
8. Minimum lighting required.

Since no two plants are identical in all of these, it can readily be seen why some systems show such low unit costs, while others seem far out of line in their data and cost figures.

Even in the Wood-Ridge plant, the factors differ according to the various

Figure 3. Curves show, over a period of 8000 hours' continuous operation, loss of light in foot-candles, without maintenance of any kind, from actual tests at Wood-Ridge, and varying unit costs of light based on installation, operation, and maintenance records

departments and locations, so that cost of maintenance varies all over the lot from one section to another. Hence, in quoting cost figures, it would be easy to choose a section where relamping is relatively easy, and thus show a very low figure, overlooking another section where costs are very high. The total cost, however, is what management is interested in. Such total costs can be truly realized only by analyzing the maintenance program over a year's time, when the lamps have been changed at least twice all over the plant and some fixtures may have required washing more often than usual because of oil fumes or excessive dirt. The cost analysis shown on page 139 is therefore based on actual over-all performances and maintenance.

Group Replacement

In formulating a maintenance program for a fluorescent lighting system, the important question arises whether lamps should be replaced periodically in groups regardless of their condition, or individually as they burn out. After reviewing the methods of relamping used in similar plants, it was decided that the group replacement would be the best for the Wood-Ridge plant for the following reasons:

1. To replace individual burned-out lamps each day over the large area to be covered would require the services of a large force of men.

2. While the light level would not go down quite as fast with individual lamp replacement, the resultant bright spots here and there throughout the plant would cause complaints from employees. Bright lamps do not look good against dull lamps, and they cause glare. It can be shown by mortality curves that, although the average life for a group of lamps is 3000 hours, 50 percent of these lamps will burn much longer but at a diminishing lumen output. By the time all of them burn out, the light is so poor the lamps can hardly be found. Also, by permitting old lamps to continue burning beside a group of new lamps, bad shadows are produced, with resultant complaints and poor work by machine operators. Eventually, therefore, group replacement would have to be made anyhow, because of large areas of poor lighting, at which time some of the lamps formerly replaced individually would be again replaced before they had burned their economical length of life.

3. A large part of the area in which difficulties are encountered in reaching the lamps have these same difficulties repetitively—that is, there are long aisles of identical machines with the same system of overhead cranes, piping, and conduits. In the system of replacing individual lamps, a lamp crew would have to spend considerable time maneuvering the ladder equipment into position to reach each lamp. In group replacement, however, the ladder is placed in one spot for each group of lamps, so that considerable time is saved on each fixture.

4. In group replacement, the different crews are kept more closely under supervision, and one leadman can keep track of several crews.

5. Group replacement also lends itself to easy methods of keeping records of lamp life and costs. With maximum lumen values of each lamp on record, lamps can be discarded once they become uneconomical to operate.

The next two points to be covered were the decision as to frequency of lamp changing and the determination of the washing schedule. Tables obtained from various lamp manufacturers, based on the average lamp life of 3000 hours, all indicated that with 26,400 lamps at Wood-Ridge burning 24 hours a day, 7 days a week, the average monthly replacement of individual lamps would be approximately 6000. This is equivalent to a relamping about every 4½ months. However, since the lamps are never turned off, it was assumed that lamp life would be much longer, and a trial period for relamping was set for six calendar months, or 4400 hours.

Washing schedules were at first set at 3-month intervals. When the lamps and reflectors were washed at that time, it was found that the increase in light intensity amounted to only 3 foot-candles. Inasmuch as such a washing schedule meant doubling the lamp cleaning force required by a 6-month schedule, it was decided that the slight improvement in light obtained thereby did not warrant this additional expense. The washing schedule, therefore, was set back to correspond to the group replacement of the lamps—namely, every 6 months. Both fixture cleaning and lamp replacement operations are now done simultaneously.

Accurate Costs

In order to obtain accurate costs of lighting maintenance, a special account was set up to which all labor and material were charged. The figures on the table on page 139 show labor costs by months as against the number of lamps changed, for period of one year ending March 31, 1945. These costs cover relamping and cleaning; cost of starter replacement is negligible because lamps are never turned off.

From these figures it will be seen that all the lamps were not changed twice during the year as originally planned. This was caused by shortage of manpower. It will also be noted that the cost of changing the lamps is steadily dropping in cost per lamp changed. This reduction may be traced to the men becoming more

skilled in their work, lowering of labor turnover, intensive study to eliminate waste labor, and institution of time-saving methods and equipment.

At present there is a force of nine men to change lamps and clean fixtures, who are classified as lamp cleaners, with a leadman in charge. These men are made up into teams of three men, and each team has its full equipment of both types of ladders (aerial and telescopic) and a wash tank. Boxes of new lamps are carried on the aerial ladder truck, but with the telescopic ladder a small hand truck is provided to carry the supply of lamps. Two of the men work on a ladder, while the third does the washing and keeps the men supplied with lamps and clean reflectors.

Although it might seem that the man doing the washing would be unable to keep up with the lamp changers on the ladder, it must be remembered that the lighting installation of this plant is not of the continuous-row type. This means that the service equipment has to be moved more frequently, an operation that sometimes runs into 10 or 15 minutes depending on the location. Where there are no obstructions, a fourth man is put on the crew to handle the lamps and reflectors between the ladder and washing tank.

Flexible Set-Up

As in all plants, absenteeism sometimes disrupts this organization. In such case, the men are re-shuffled into teams of three men and the remaining one or two men are put to work cleaning incandescent lights, bench lighting, and desk lights, which does not require any special equipment except a small stepladder. At other times, the extra men are made up into four-man teams and used in servicing aisle lighting.

In order to keep track of the areas relamped, a large blueprint of the plant is located at the leadman's desk, with large-head thumbtacks on which dates can be written. Wherever possible, the lamp crews work from one side of the building across to the other side. Sometimes the men have to disrupt this schedule, because of production schedules, emergency work, temporary shutdowns, and the like, and work in other areas in order to take advantage of circumstances that improve their ease of work.

The above procedure outlines the lighting maintenance program now in effect at the Wood-Ridge plant. But how near does this program approach the most efficient utilization of the lighting equipment strictly from a lighting economics viewpoint? That question is answered by the development of the two curves shown in the graph in Figure 3, which deal only with the facts of lighting values and costs, and ignore the all-important effects of illumination on the worker and his productive efficiency.

The curve on the left side of Figure 3 shows the loss of light, in foot-candles, of the lighting equipment at Wood-Ridge over a period of service of 8000 hours' continuous operation without maintenance of any kind. It is a composite of the separately measured effects of dirt, lamp depreciation, and lamp outages on effective light output. These data were determined by using an area of six square bays as a testing ground. Beginning with clean fixtures and new lamps, careful light-meter readings were taken month by month under the various conditions involved. In all cases, voltages of the lighting circuits were checked so that readings represented identical voltage conditions.

COST OF RELAMPING AND CLEANING FLUORESCENT LIGHTING SYSTEM

Month	Number of Lamps Changed	Labor Cost	Cost per Lamp
April, '44	4116	$2548	$0.62
May	4250	2342	.55
June	3820	1602	.42
July	3100	1915	.62
August	3250	2044	.63
September	3500	1670	.48
October	3300	1696	.51
November	3720	1648	.44
December	3500	1395	.40
January, '45	4900	1552	.32
February	3760	1470	.39
March	4110	1400	.34
	(total)	(total)	(average)
	45,326	$21,282	$0.475

In the right-hand curve are shown the varying costs of light at Wood-Ridge, in cents per million lumen hours, over a similar period of 8000 hours' continuous operation. The derivation of this curve, while strictly mathematical, depends upon actual costs incurred in the installation and maintenance of the Wood-Ridge lighting equipment, using 100-watt white fluorescent lamps. The lumen values were obtained from laboratory data of the lamp manufacturer.

Briefly, the curve is based on the relationship of the total lumen output to the accumulative cost of lighting. The total lumen output is adjusted for gradually decreasing values caused by depreciation of the lamp and effects of dirt. The accumulative costs of lighting at any point comprise (1) amortization of original fixture investment, (2) lamp cost, (3) cost of current, and (4) cost of labor and material for replacements and repairs, such as starters and ballasts.

It is obvious why the unit cost of light for the first thousand hours should be high and why it declines sharply until several thousand hours have elapsed. At the point of about 4000 hours, however, the lumen output begins to decrease at a rate faster than the increase in lighting costs, with the result that unit cost of light gradually increases from that point on. It will be noted that the unit cost of light varies only within 4 cents of its lowest cost between the point of 2000 and 7000 hours' service, and varies within only 1 cent of the lowest cost in the interval of service between about 2700 and 5500 hours.

What It Proves

The significant conclusion from a study of both these curves is that the decision as to the frequency of relamping should depend upon the minimum intensity of light allowable for good production. Although unit cost of light between 2700 and 5500 hours of service varies less than 2 percent, the candlepower in this period drops about 30 percent, or to a value less than half that of new or relamped and cleaned equipment.

It does not require the use of a light meter to show light depreciation with the aging of lamps. When relamping was first done at Wood-Ridge on a group replacement basis, the plant superintendent thought that the older sections of the plant were running at low voltage. The dividing line between a relamped section and an old lamp section appeared almost as a distinct line on the floor. It took a lot of talking to convince the production department that the lower light level was caused by lamp depreciation.

At Wood-Ridge, where most of the work is of a high precision nature, good lighting is a "must." But the morale of employees is also a factor that cannot be ignored. There has been a noticeable uplift in morale whenever relamping has taken place.

Consequently, Wood-Ridge tries to gear its lighting maintenance program primarily to production requirements, in the realization that increased production and less scrap, made possible by good lighting, throw the balance of economic consideration that way.

Planning Whether to Repair, Replace, or Add

F. R. WEAVER, Vice-President and Budget Director, and H. C. ATKINS, Jr., Vice-President in Charge of Manufacturing, E. C. Atkins & Company, Indianapolis

A RECONVERSION PROBLEM

A "CONDITIONS" INVENTORY of all production machinery and auxiliary equipment in the Indianapolis plant of E. C. Atkins & Company was the basis for planning needed repairs to meet post-war manufacturing requirements.

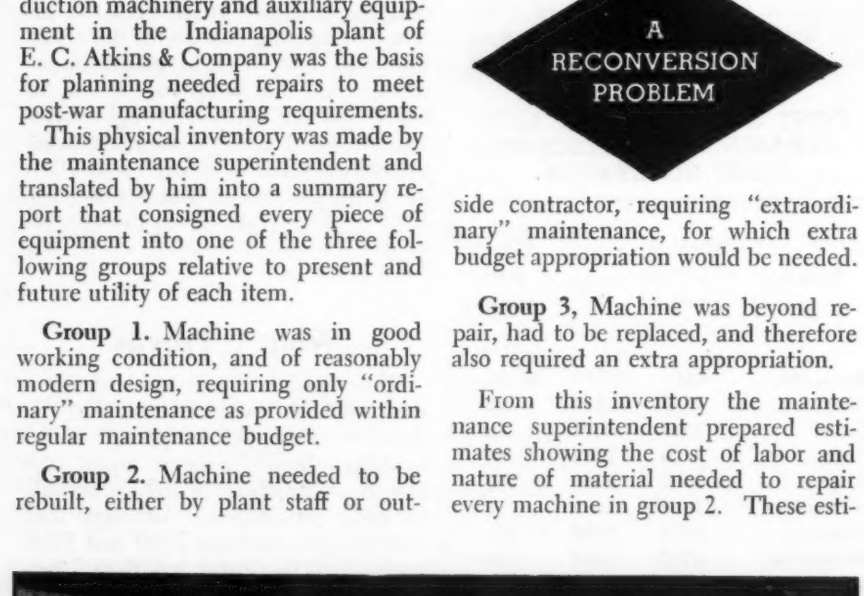
This physical inventory was made by the maintenance superintendent and translated by him into a summary report that consigned every piece of equipment into one of the three following groups relative to present and future utility of each item.

Group 1. Machine was in good working condition, and of reasonably modern design, requiring only "ordinary" maintenance as provided within regular maintenance budget.

Group 2. Machine needed to be rebuilt, either by plant staff or outside contractor, requiring "extraordinary" maintenance, for which extra budget appropriation would be needed.

Group 3, Machine was beyond repair, had to be replaced, and therefore also required an extra appropriation.

From this inventory the maintenance superintendent prepared estimates showing the cost of labor and nature of material needed to repair every machine in group 2. These estimates were used to enable intelligent discussion by management when it submitted requests for extra appropriations to the board of directors for approval.



When taking the machine inventory, the maintenance superintendent consulted the production foreman, and frequently the operator, to determine condition of a machine and its value as a production unit

Manufacturing operations at this plant utilize more than 2000 pieces of equipment, of which about 1000 are machine tools and the rest heat-treating units, transportation facilities, and a large variety of auxiliary production and plant service equipment. All require routine maintenance, which normally requires more than 50 machinists, millwrights, electricians, and other specialists, under the direction of the maintenance superintendent.

All items of capital equipment are identified by numbered metallic tags, and a historical record card is carried by the accounting department throughout the life of each item, showing original cost, transportation and installation charges, complete description of the item and its accessories (motors, etc.), date of installation, and location. In addition, this same department keeps a maintenance record for each item, listing monthly the charges for maintenance labor and materials.

Ordinarily, the maintenance records are reviewed periodically, and items that show excessive maintenance costs are listed for rebuilding or replacement. Owing to the unusual load imposed on many machines during the war period, however, through speed-up of operations and extra shifts, it has been impossible to keep all machines in first-class working order. Their condition therefore reflects an accumulative maintenance deficiency which cannot be overtaken by short periods of shutting down for repairs.

Complete Overhaul

Furthermore, there is always a tendency to keep essential machines running until they produce defective work. At this juncture an "extraordinary" repair finally becomes essential, and the machines are taken out of production for the period necessary for overhaul.

With the ever-growing demand for

MACHINE NO.	NAME OF MACHINE	CONDITION			REMARKS
		GOOD	BAD	FAIR	
	Department 4 - Inserted Tooth				
128	Line Shaft Motor 3 HP	x			
129	Circle Miller for Holders	x			
131½	Line Shaft	x			
132½	Circle Milling Machine			x	$75-00 hours—2 new spindles and bearings
133	#6 Grinder D. E.	x			
133½	Circle Miller for Bits			x	$5-00 hours—needs adjusting
134	#13 Miller Cross Mill Holder		x		$100-00 hours—new lead screw and nut
134½	Line Shaft Motor	x			
135½	Blower for 292-A	x			
136	Lathe	x			
136½	Finish Grinder	x			
137	Gas Ann. Forging Furn.	x			
137½	#3 Miller			x	$75-00 hours—repair ways
138	Rough Grinder		x		$100-00 hours—new bearings and shafts

Figure 1. On simple form, maintenance superintendent filled in his appraisal of condition of each machine, nature of needed repairs, estimate of hours and cost of labor to make repairs

"extraordinary" maintenance work, it was finally decided to survey the situation to determine the over-all requirements and to facilitate the organization of a separate repair department to cope with the problem. Accordingly, the maintenance superintendent was requested to report the condition of every item of equipment in the plant, together with his recommendations as to the action to be taken with respect to items needing "extraordinary" repairs. After careful review of the problem, it was decided, in the interests of accuracy and the saving of time, first to have the maintenance superintendent make a physical survey of each department rather than to rely on the maintenance records which for reasons already explained could not reveal the present conditions. Furthermore, it was recognized that it would be of considerable advantage to consult with each production foreman, and in many instances with the machine operator, in determining the condition of the machine and its value as a production unit.

Survey Took Three Weeks

The physical survey was completed in about three weeks, using the simple form shown in Figure 1. Typed lists of all equipment, showing departmental location, name, and tag number, were prepared by the accounting department to simplify the task of the maintenance superintendent. He had only to fill in with pencil his findings as to the condition of each item and its requirements for repair.

Another week was required by the maintenance superintendent to summarize his findings in a summary report (not shown) showing (1) estimated cost, both in man-hours and dollars, for all "extraordinary" maintenance items—i.e., rebuilding machines requiring major repairs; and (2) estimated cost of replacement machines. This summary report was sent to the budget department for preparation of a "special request" to go to the board of directors for a fund to finance both the major repair program and the purchase of replacement items. The request showed all pertinent facts, to permit the directors, who naturally enough are not always familiar with the mechanical operations involved, to pass intelligent judgment on the validity of the recommendations.

In the preparation of the "special request" by the budget department, all items of equipment were classified into two groups: (1) Machines to be rebuilt; (2) machines to be replaced—i.e., costing more to rebuild than to replace.

In determining the latter group, the maintenance superintendent had to investigate carefully the possibility of obtaining replacement machines. It is not easy to obtain machine tools on short notice, and in many instances the decision to rebuild was made because of the impossibility of waiting many months for a replacement.

As valuable as the physical inventory of all equipment was, however, for indicating the steps necessary to restoration of existing equipment, it did not in any way insure the adequacy of that equipment for post-war manufacturing requirements. It became apparent that a fourth group of machine tools and equipment was involved, which would complete the steps necessary to obtain a plant geared for lower-cost higher-volume output.

This group consisted of new machine tools and equipment which were needed to (1) reduce existing bottlenecks; (2) reduce manufacturing costs; and (3) increase production.

Separate Survey

A separate survey was conducted by the tool and process engineering department to develop this information. As in all cases where new equipment is recommended, the results of this survey were submitted to the manufacturing vice-president, who obtained all necessary data as to competitive types, savings to be accomplished, and installation costs. From these data the budget department was able to prepare a separate request for purchase appropriations, for approval of the board of directors.

The survey of group 4 machinery and equipment is actually on a continuing basis. Periodically the budget department prepares a request for appropriation for "extraordinary" expenditures for new equipment, supported by the data accumulated by the

manufacturing division. In fact, this method of control extends to all departments for all expenditures not within the normal budget. As far as maintenance is concerned it claims two valuable advantages:

1. Extraordinary maintenance and replacements are not buried in manufacturing expenditures.

2. Management is able to pass judgment on major items of plant upkeep before the money is spent.

The procedures for these two special surveys have resulted in a comprehensive program that is gradually eliminating the accumulative maintenance deficiency and is increasing productive efficiency. It will be recalled that the summary report of the maintenance superintendent showed the total number of maintenance hours in arrears, or those needed to recondition the productive and auxiliary equipment. From this it was determined that a supplementary maintenance department of 11 men was needed to complete the rehabilitation program over a given time.

Attendance Chart Spurs Maintenance Efforts

WILEY CRAIG, Plant Engineer, The Dayton Rubber Manufacturing Company, Dayton, Ohio

ABSENTEEISM is being kept low in the maintenance department of The Dayton Rubber Manufacturing by public display of the attendance record of each employee on a monthly calendar chart. One chart is kept on the wall of the plant engineer's office, and a duplicate is located near the time clock in each of two maintenance workshops.

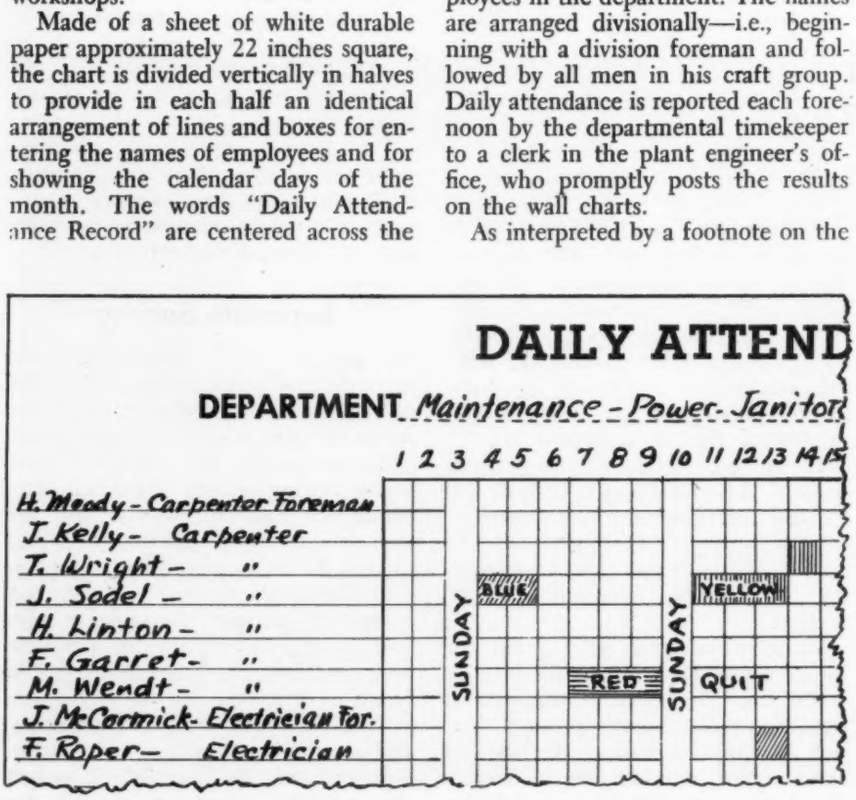
Made of a sheet of white durable paper approximately 22 inches square, the chart is divided vertically in halves to provide in each half an identical arrangement of lines and boxes for entering the names of employees and for showing the calendar days of the month. The words "Daily Attendance Record" are centered across the top of the chart in ½-in. letters. Immediately underneath this heading, is a line on the left half of page for entering the department name, and a similar place on the right half for the month.

Each month a new sheet is made up, showing the names and occupations of all supervisory and regular employees in the department. The names are arranged divisionally—i.e., beginning with a division foreman and followed by all men in his craft group. Daily attendance is reported each forenoon by the departmental timekeeper to a clerk in the plant engineer's office, who promptly posts the results on the wall charts.

As interpreted by a footnote on the chart, a black check-mark indicates "at work"; for all absences, however, the daily square is filled in crayon colors of either blue, yellow, green, or red. Blue indicates a reported illness; yellow, an absence by prearranged permission; green, a vacation absence; and red, an unreported absence. Blue absences are checked by a visiting nurse to guarantee necessary medical attention for obtaining earliest recovery. The plant rules provide for automatic discharge for 3 consecutive red days if no legitimate excuse can be given.

In addition to the self-disciplining and salutary effect from publicly informing an employee's associates of the reasons for his absence, this chart has developed other advantages. It saves time consumed in thumbing cards by the plant engineer and foremen when reviewing a man's attendance record for factors entering into consideration of merit increases and promotion. It enables maintenance supervisory men to get a quick graphic picture of the current status of their personnel.

How well the chart is fulfilling its prime function of reducing absenteeism in the maintenance department is attested by the results. Workers gather around the bulletin boards to boast of their clear records and to "ride" others who have not been faithful in attendance. Maintenance foremen are quick to complain of any delay or oversight in posting attendance because they know any lag in this program will affect their production unfavorably. Management has stimulated the program by adding special recognition for perfect attendance.



Part of attendance chart for maintenance workers. It shows how absences are marked in colors. Blue means reported illness; yellow, excused absence; green, vacation; red, unreported absence

War Production Committee Lends Aid to Maintenance

V. H. VERBY, Personnel Director, Russell & Erwin Manufacturing Co., New Britain, Conn.

TWO LABOR-MANAGEMENT SUBCOMMITTEES in the New Britain plant of Russell & Erwin Manufacturing Company are rendering splendid service in functions that are of particular interest to the plant engineering department. They are known as the Safety, Health, and Fire Prevention, and the Utilities and Conservation Committees.

Following the suggestion of Donald M. Nelson, then Director of the War Production Board, a War Production Council was organized in this plant in November, 1942. This council is composed of an executive committee and a production committee. The executive committee has six members, three appointed by and representing management, the other three being appointed by the union and representing labor.

Make-Up of Committee

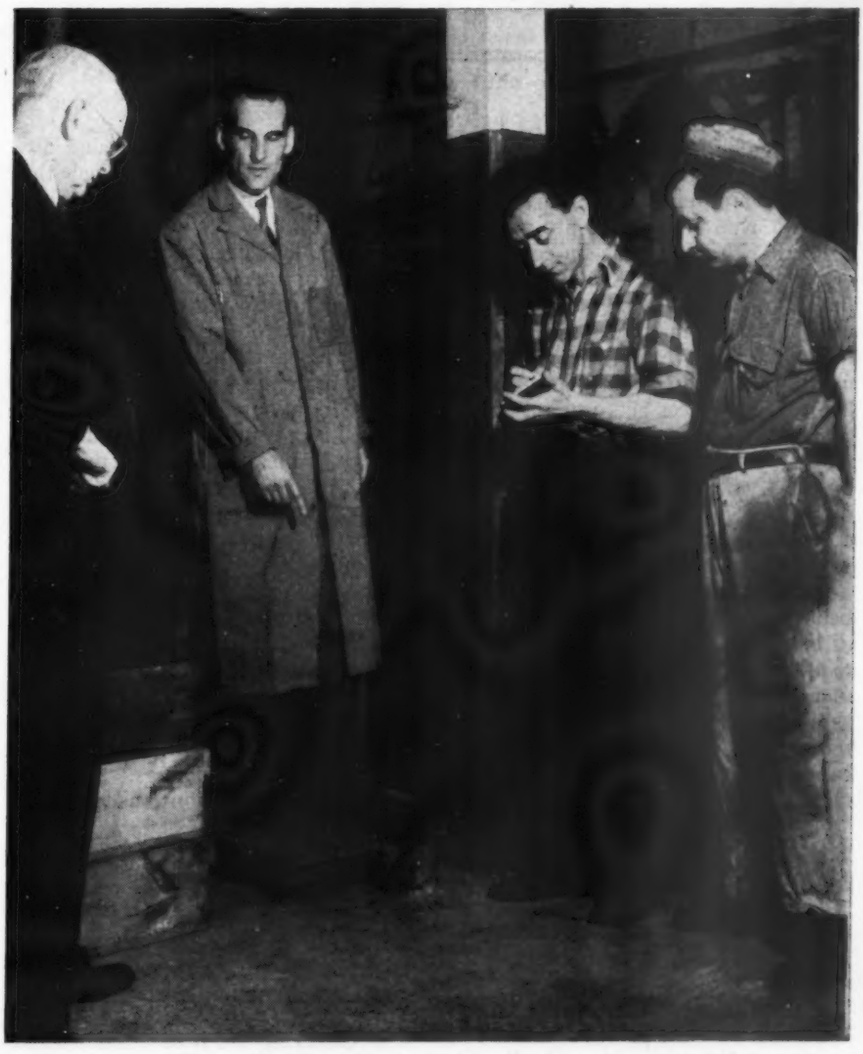
The production committee consists of two members from each department or working unit. One member is the department foreman, while the other member is chosen by ballot by the workers of the department or unit. The production committee member in each department appoints subcommitteemen to assist in carrying out the various functions. At present there is a subcommittee chairman from each shift for the following functions—safety, health and fire prevention, lost time, production and methods, publications, utilities, conservation, and suggestion system. The number of members on these subcommittees varies from time to time, but the minimum is from four to six.

Members of the different committees are chosen with much care, particularly to insure the selection of men who are thoroughly familiar with the subject which is that committee's particular concern. For example, one of the members of the health, safety, and fire prevention committee is a tool- and die-maker. His long experience enables him to detect immediately any unsafe conditions on production machines. An electrician is one of the other members. He is in position, naturally, to detect any hazardous conditions centering around all kinds of electrical equipment. Another member is a key man in the plating room. Here conditions affecting the health and safety of workers are carefully watched, and precautions and hazards are continually posted for the welfare of the department.

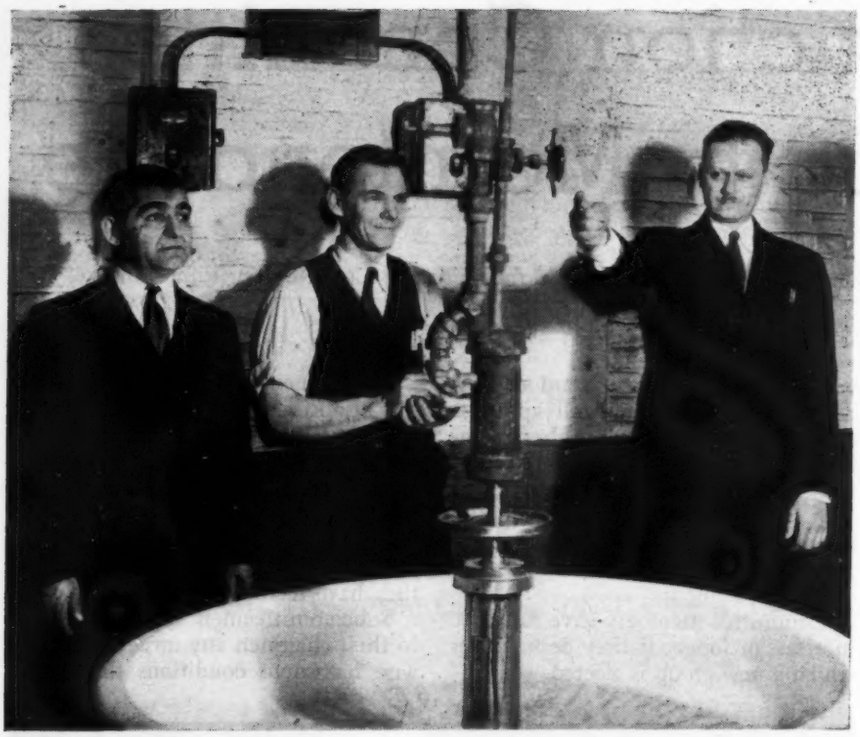
Committee members serve for three months, or longer if they desire, after which a new group is elected.

These men invariably take their obligations very seriously and do their utmost to uncover any conditions that are not as they should be. In the discharge of their duties they are given valuable assistance by their co-workers in the various departments, who report any undesirable condition which they have seen.

Subcommitteemen report at once to their chairmen any unsafe or otherwise hazardous conditions that come



Chairman of the safety, health, and fire prevention committee points out the hazard of a projecting water pipe to the plant superintendent



Utilities and conservation committee suggests a cross bar on hot water valve to enable workers to shut water off completely

or are brought to their attention. The subcommittee chairman, in turn, reports immediately to the department foreman whose responsibility it is to order that the condition be corrected, assuming that it is something that should receive attention at once. The department foreman is asked to correct the condition at once, or if it is a matter beyond his control, an order to the plant engineer gets prompt attention from the maintenance department. The subcommittee chairmen makes a written report on every condition reported. In a few days the committee makes a check in the department to see that the condition has been remedied, or that an order has been put through to correct the condition. If the matter is such that it requires attention from top management, a report is made in writing to the plant superintendent, and a written reply is requested to satisfy the committee that conditions are being taken care of.

Monthly Meetings

Each committee meets once a month with its chairman. The safety, health, and fire prevention committee meets with the plant superintendent. The utilities and conservation committee meets with the plant engineer. The personnel director meets with all committees for the purpose of speaking authoritatively for management. At these meetings there is a thorough discussion of all matters with which the committee is concerned. Suggestions are made on how the undesirable condition that has been reported can be remedied or avoided. Minutes of the subcommittee meeetings are recorded and submitted to the general chairman of the committee. An important part of each meeting is the checking up to determine what action has been taken on previous recommendations.

At the general committee meeting, held once a month, each subcommittee is represented by its chairman and members. Each committee presents its minutes for the approval and discussion of the entire committee.

The safety, health, and fire prevention committee is particularly concerned with such matters as uncovered oil cans; collection of waste materials; need for, and condition of, guards on machines; departmental housekeeping; needed repairs to buildings. A partial list of recommendations made during the past year includes:

1. A new method of handling acid bottles.

2. Cutting down top steps of movable stairs to fire escapes, in order to eliminate stumbling hazards.

3. Checking fire hose nozzles when they are not connected to pipelines.

4. Removal of steel step at entrance to brass gating room, to eliminate the slipping hazard.

5. Correcting oil leakage from electric trucks.

6. Installation of walks to cellar entrance of Building 24.

7. Placing sand containers at gate entrances to receive cigarette butts.

8. Installation of draft baffles in front of elevators.

9. Cleaning and painting toilets in sandblast room.

10. Painting handrails or background white, to aid in locating these rails in stairways during power failures.

11. Cleaning up scrap and debris at boiler house smokestack.

12. Eliminating water in driveway of Building 25, coming from the blower in the door-check room.

13. Repairing floors in the blacksmith shop.

In addition to recommendations such as these, all broken windows, defective roof drains, roof leaks, defects in walls, and any hazards to safety and health are reported immediately by the committee members.

In discharging its functions last year, the utilities and conservation committee worked out an arrangement with all manufacturing departments whereby the foreman of each department appointed two persons to keep a check on the use of light, water, and power, and particularly the running of power-using equipment when not in use. The committee members make frequent inspections to see that these matters are watched closely.

Conservation of water, especially in the plating room, has been given particular attention and a considerable amount has been saved.

This committee also discovered and reported a break in the main steam line, thereby securing immediate attention to a condition that might have had disastrous results if not remedied.

Another recommendation involved the installation of cross bars on hot water valves to make it easier for workers to shut them tightly and thus eliminate dripping and waste.

The work of these two committees in reporting conditions that need attention has been of the utmost value in the maintenance department. This department, of course, has its own inspectors, but it would be impossible for the present force to cover the ground so frequently and thoroughly as is now being done. And that means a cleaner, safer plant than would otherwise be possible.

How to Plan Plant Distribution Systems

D. L. BEEMAN, Industrial Engineering Division, General Electric Company, Schenectady

A RECONVERSION METHOD

WHEN PLANNING an electric power system the first and most important step is to make a one-line diagram of all parts of the system from the power source to the utilization devices. After this diagram has been drawn, equipment specifications can be prepared and layout details made.

Only by over-all planning can one be sure of getting a co-ordinated system. Without this master plan, you have no plan or map to guide you through the mass of details in preparing specifications and making detailed installation drawings. In many instances a complete one-line diagram may be used in place of specifications for ordering equipment.

Before the diagram can be made, all the data possible relative to the load in the proposed plant must be collected. If similar plants are in existence, visit them and learn what their demands and their diversity factors are. There is, unfortunately, not much information available in technical literature to help designers estimate loads. However, some useful figures are given in the publication, "Electric Power Distribution for Industrial Plants," published by the AIEE Committee on Industrial Power Applications, of the American Institute of Electrical Engineers.

Getting Load Data

It is not practicable to select a number of substations and decide on their location until some idea of the load requirements has been obtained.

One of the most outstanding errors made in planning many war plants was the failure to take advantage of load information available on existing plants. When many of the first plants were planned, no such data were to be

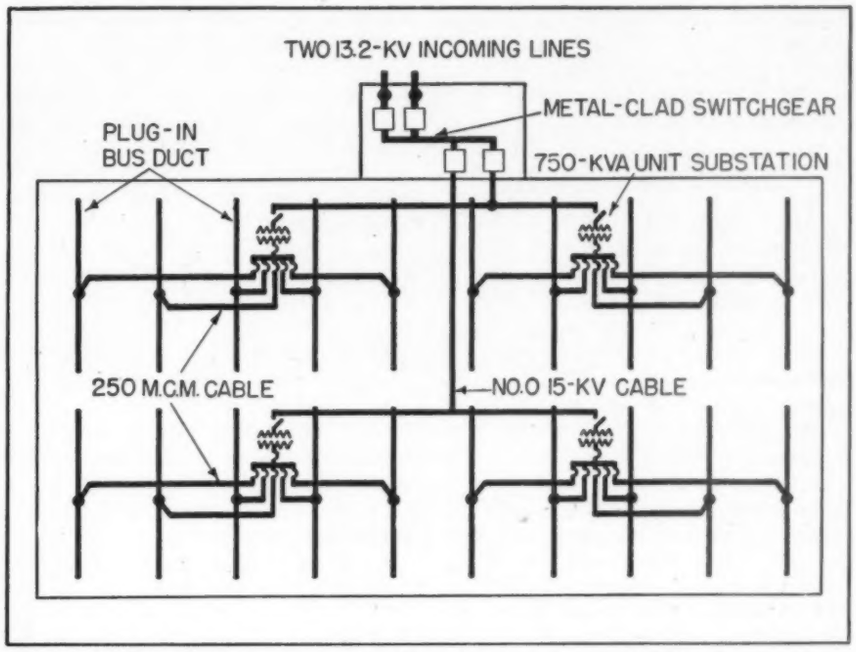


Figure 1. One-line diagram of a load-center power distribution system for a factory having about 300,000 square feet of floor space

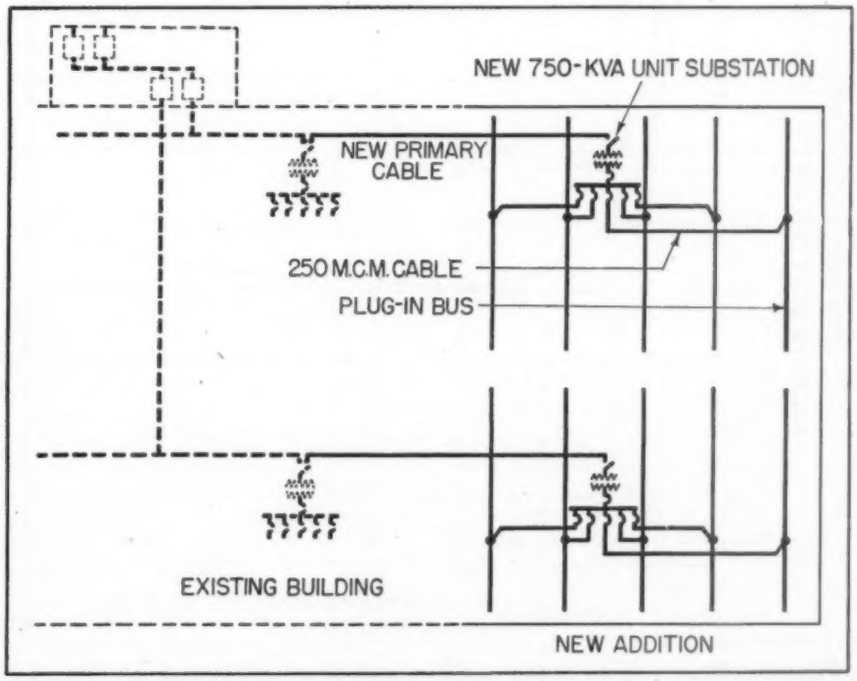


Figure 2. One-line diagram indicates how easily the load-center system can be expanded to accommodate plant expansion or load growth

had. By the time the second and third installations were made, however, good operating data were usually available.

It is not always necessary to know the rating of every motor and the demand of every electric device to be used in the plant. One can work with satisfactory results from load density figures—that is, voltamperes per square foot of floor area required for various types of manufacturing processes. For example, in general manufacturing areas such as used in fabricating plants, the voltamperes per square foot, including lighting, range somewhere between 10 and 20. For general estimating purposes, a figure of 15 voltamperes per square foot seems reasonable.

Allow for Growth

After the initial load in the plant has been determined, the next most important step is to allow for future load growth and expansion. Over a period of years the amount of energy used per square foot of floor space increases because of more intensive manufacturing methods and expansion.

Perhaps the greatest single error in industrial power system planning is the failure to allow for load growth. It is so often stated, "This is the last expansion we are ever going to make." Invariably, a few years after the last expansion still another one is planned. If a long-term plan has not been made to allow for these inevitable expansions, bottlenecks in electrical systems arise that interfere with extension of the electrical facilities. As a result of this lack of planning for future load growth, the over-all investment in these electrical systems is increased materially, the systems lack flexibility and reliability, often become unsafe.

Allow for more generating capacity, or for a larger tie from the utility, and also for more step-down substations to be added. It is perfectly feasible, by using modern industrial power system engineering practices, to allow for load growth with little extra expenditure for the original installation.

For example, by the use of a load-center power distribution system where small substations are used at the load centers, Figure 1, the plant may be enlarged merely by extending the high-voltage feeder and adding new substations, as Figure 2 shows. This extension usually will not affect the substations already installed. On the other hand, where all the power is put on one big substation bus any addition of capacity adds to the short-circuit current and to the complication of getting the feeders away from the big substation.

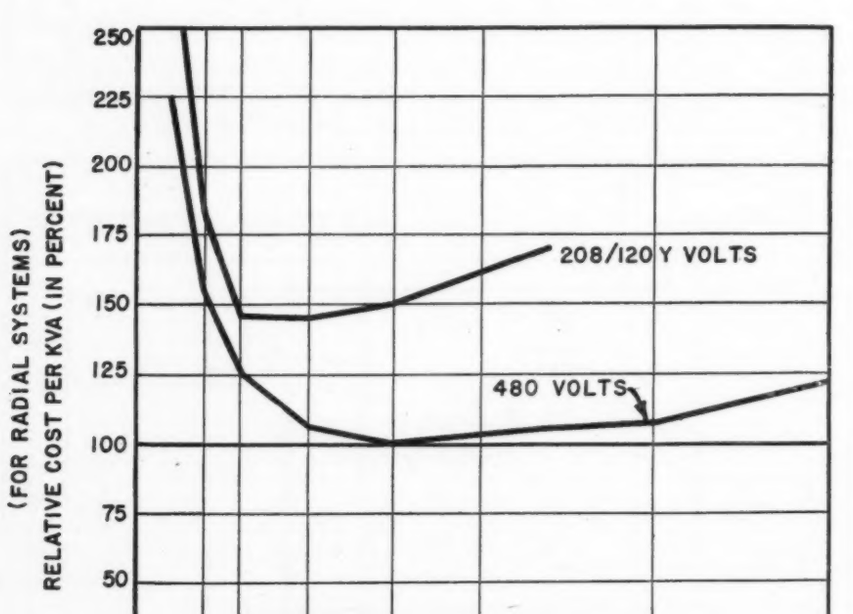


Figure 3. Shown here is the relative cost of a load-center system as a function of the secondary voltage and of the standard kva. ratings of load-center unit substations, for 480 and 208/120 Y volts

Many smaller plants are served directly from the utility line operating at 15 kv. or less. In such instances the primary voltage can be used for distribution to the load-center unit substations within the plant. Here there is no choice of primary voltage, since that is determined by the utility supplying the power.

In many plants, however, the utility supplies a voltage above 15 kv. It is generally conceded that higher voltages should not be taken into the plant. Therefore a transformation is required from the higher utility voltage to the primary voltage at which power is carried to the step-down substations located at the load centers.

Here selection of voltage is a vital matter. The selected voltage must be high enough to allow for future load growth and additions to the plant supply without imposing serious bottlenecks as to short-circuit current and limitations in the application of switchgear.

Select a High Voltage

In many plants, a primary voltage of 2400 was selected. When this selection was made the total load in these plants might have been on the order of 5,000 to 10,000 kva. Today many of these plants have grown to 30,000 or 40,000 kva. capacity. It is uneconomical to handle large loads at 2400 volts. If in the original planning a higher voltage, such as 4.16 or 13.8 kv., had been chosen these plants would be free from short-circuit current bottlenecks and also from excessively expensive reactor and switchgear installations. In addition, they would have more flexible systems.

Recent studies have shown that there is no economical justification for selecting 2400 volts in preference to 4160 volts. The higher the voltage, the greater the kva. that can be carried per feeder and the greater the kva. substation capacity that can be bussed together without exceeding a given short-circuit current level. For small and medium-sized plants, up to about 10,000 kva. total capacity, 4160 volts is a reasonable selection. In plants with a total capacity above approximately 10,000 kva., however, it is desirable to select 13.8 kv. Electrical systems of 10,000-kva. capacity may cost slightly more at 13.8 kv. than at 4160 volts at that load level, but as the plant grows expansion is simpler and less expensive at 13.8 kv., so that in the long run this voltage would be justified even for the initially smaller plant.

There seems to be no justification for selecting 6.9 kv., instead of 13.8

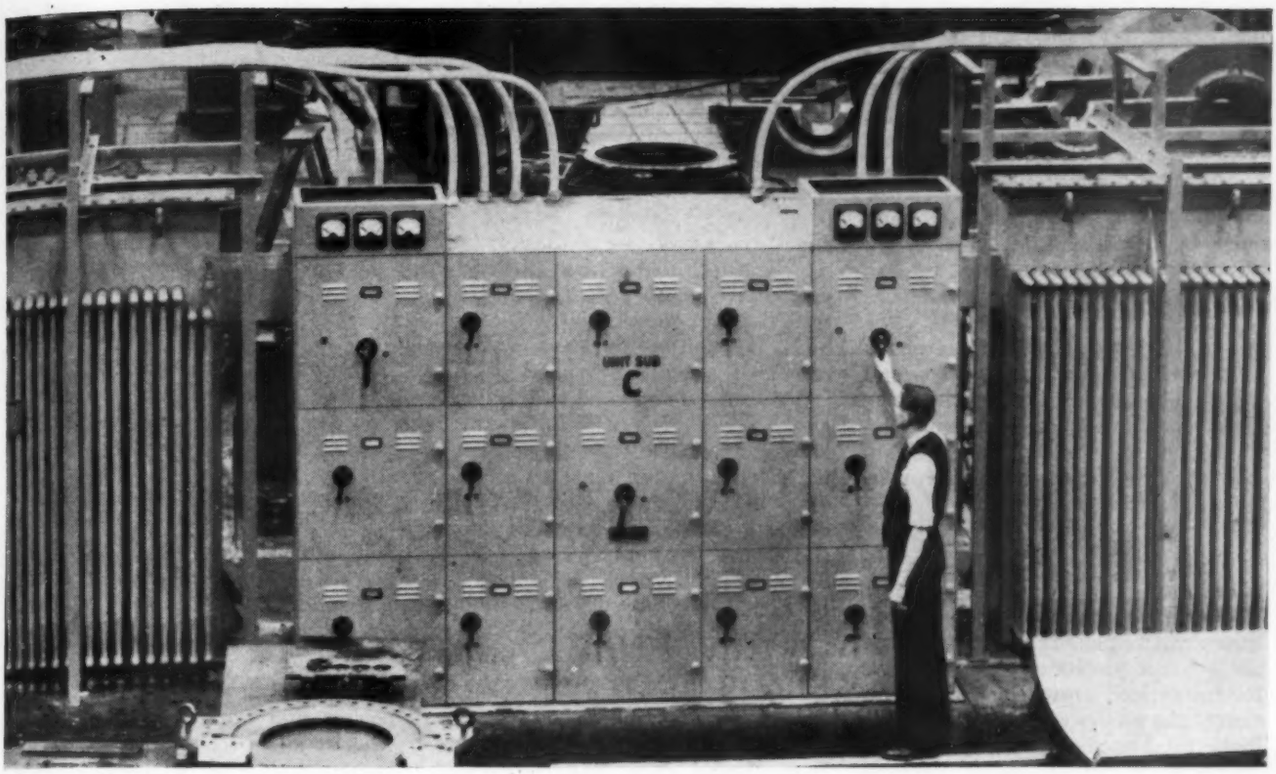


Figure 4. Here is a load-center unit substation installed in a turbine factory. For maximum safety, all live parts are enclosed in grounded metal. Such protection assures little chance of accidents

kv., except in certain very heavy industries, such as steel mills, where 6.9 kv. can be made an effective utilization voltage. For general distribution, circuit breakers for 6.9 kv. cost as much as breakers for 13.8 kv. Hence there is no difference from the switchgear standpoint. It takes smaller cable to carry a given load at 13.8 kv. Therefore, a slightly lower cost will be obtained at the higher voltage.

Regulate the Voltage

In some instances the question arises as to the choice between 4160 volts with grounded neutral, and 4800 volts delta. The lower voltage, 4160, permits application of standard 5-kv. metal-clad switchgear. Usually 4800-volt circuits cannot employ standard 5-kv. metal-clad switchgear because the voltage may go over 5 kv. on the 4800-volt system. Also, 4800-volt systems usually are not grounded at the system neutral. The latter limitation can be removed, however, by system neutral grounding. In general, 4160 volts should be selected rather than 4800 volts because of the greater flexibility and economy in applying standard metal-clad switchgear.

Three voltages are commonly used for power equipment—namely, 230, 460, and 575 volts. Use of 460 volts is by far the most common. Installations for 230 volts are considerably more expensive than those for 460 volts, as will be seen from Figure 3. Although 575-volt systems are less expensive for switchgear and cable than 460-volt systems, they require 550-volt motors and control, which are not generally stocked and therefore are not so readily available.

In general, voltages lower than 460 volts are justified for only two reasons: (1) To supply loads such as incandescent lamps, fractional-horsepower motors, hand tools, and soldering irons, for which 460 volts are not suitable; and (2) where a lower voltage to ground is required for safety reasons, as with hand tools and office wiring.

In general, only a small portion of a factory load must operate at less than 460 volts. This load may be supplied from the 460-volt power system through the use of step-down, dry-type transformers.

Where the main load consists of fractional-horsepower motors, hand tools, and like equipment, as in a clothing factory, 208Y/120 volts is usually the desired voltage, rather than 230 or some higher voltage. Wherever possible, choose either 460 or 208Y/120 volts.

The voltage variation from no load to full load must be kept within limits that will provide satisfactory performance of all electrical equipment. This variation includes the voltage drop in the plant and the regulation of the source. For proper performance of electrical devices the voltage should not be outside a band of 420 to 480 on 460-volt circuits. Should the voltage check show that these limits are exceeded, install voltage regulation in the form of a separate regulator or a tap-changing transformer at the plant source.

Voltage that is either too high or too low poses a problem in many plants. When it is too high, the life of motors, contactor coils, lamps, and electronic devices is shortened and the power factor of motors becomes very poor, thus increasing the penalty for low plant power factor. When the voltage is too low, fluorescent lamps fail to light, motors have too low torque, and solenoids do not operate properly.

Protect Properly

When in doubt, install a voltage regulating device and make sure of adequate voltage—not too high, and not too low. Remember that industrial plant loads consist of more than electric motors. In general, other equipment—lamps, solenoids, and electronic devices—require much closer voltage regulation than motors.

Adequate short-circuit protection of the electrical system is recognized as an essential in every modern industrial plant. This protection is assur-

ance that a fault will be localized to the circuit involved, and will not spread back into the system and cripple the entire plant because of failure of inadequate short-circuit protective devices.

The lack of adequate short-circuit protection is probably the most troublesome characteristic of many older industrial systems. Here again, this situation has come about by lack of over-all system planning and failure to allow for future load growth. The power systems in many of these plants were installed 15 or 20 years ago, and although the circuit breakers had adequate interrupting capacity when installed, little thought was given to load growth. Hence the old breakers are now totally inadequate.

What to Consider

The most important factors to consider when planning for adequate short-circuit protection with a reserve for future load growth are: (1) Selection of the proper voltage—that is, the highest voltage practicable; and (2) selection of power circuit breakers with a reasonable margin between their interrupting rating and the initial interrupting duty.

Short-circuit protection must be considered throughout the entire power system.

An example of the importance of short-circuit protection throughout the system was shown in a New England mill. A motor starter failed when a short occurred in the leads between the starter and the motor. The fused knife switch ahead of the starter failed because it also had inadequate interrupting capacity. The branch feeder breaker was inadequate, and it also failed. Each time one of these failures occurred it created a new fault in the device that failed. The end result was the opening of the power company breaker, which caused a service outage of several hours in this plant.

More and more attention is being given to safety of personnel in modern industrial plants. This applies to the electrical equipment as well as to other operating equipment. A high degree of safety can be designed into the electric power system by using metal-enclosed switchgear and enclosing all live parts within grounded metal, to prevent accidental contact by the operators or others.

Design for Flexibility

A second, and very important, safety feature is the use of switching and motor-starting equipment of adequate interrupting rating.

With the advent of unit substations located near the working areas, it has become imperative to use substations with all live parts enclosed in grounded metal, and switching equipment of adequate interrupting capacity. If these principles are adhered to, installations like those shown in Figure 4 will provide a high degree of safety.

An electric power distribution system in an industrial plant ought to have sufficient flexibility to meet varying load conditions and to allow easy expansion. It should permit:

1. Loads to shift from one location to another within reasonable limits without requiring constant juggling of the power system.

2. New loads to be taken on without changing the existing parts of the system.

3. Varying degrees of service reliability throughout the manufacturing plant, depending upon the particular operation encountered.

The modern load-center distribution power system meets all these requirements. It can easily be expanded merely by extending the high-voltage feeders and adding new substations when and where desired. There are several forms of load-center power systems available, such as straight radial, secondary selective, and secondary network, which provide varying degrees of service reliability as demanded by a particular application.

By using plug-in bus distribution, Figure 5, the load devices may be

Figure 5. In this machine shop the plug-in bus duct used for distributing power to the machines simplifies the wiring problem when locations are changed. It eliminates need for expensive reconnections

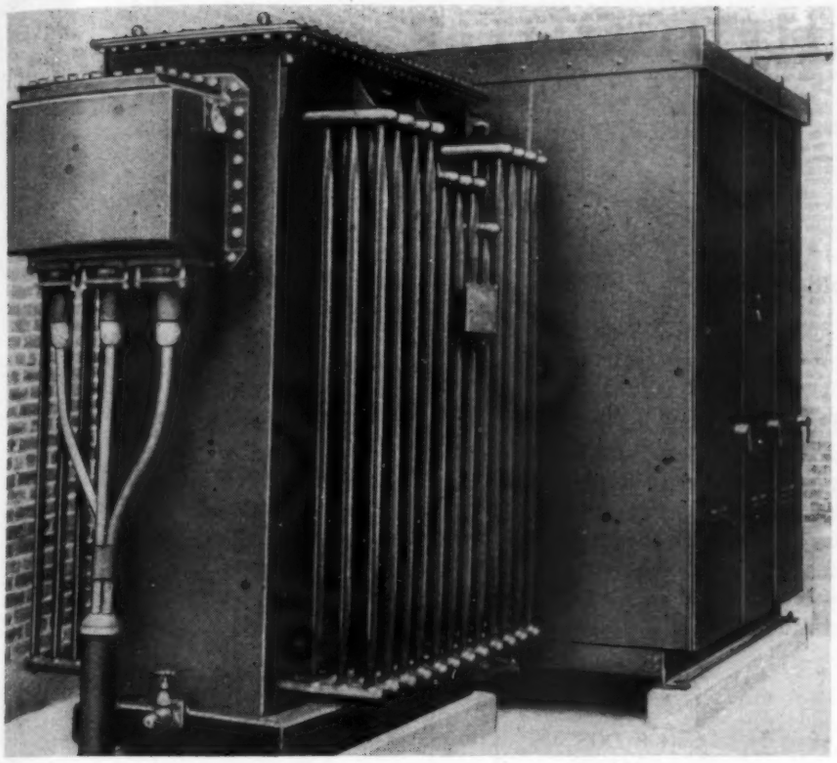


Figure 6. It was necessary to locate this load-center unit substation outdoors, but it was placed near the center of the load

shifted easily without necessitating expensive reconnections.

An industrial electric power system ought to be simple to operate. Make the diagrams and circuits straightforward. Then emergency operation becomes easier and more positive. It is usually under the stress of an emergency that mistakes in operation are made. Obviously, it is less likely that such mistakes will be made in a simple system than in a complicated one.

Simplicity in relaying and in the devices selected is also important. If complicated devices are used, the maintenance personnel may not understand them, and consequently may not take proper care of them.

Use Circuit Breakers

Complicated interlocking schemes involving disconnect switches in main power circuits detract from simplicity and lower the degree of safety. It is for this reason that circuit breakers should be used for switching all major power circuits, so that they can be switched at any time without considering the complicated interlocking or routine necessary to energize or de-energize a particular circuit. Disconnecting switches are used widely on the primary side of load-center unit substations, but the switches usually are arranged to break transformer magnetizing current only.

Many industrial plant power systems have been well designed on paper. The one-line diagram provides adequate flexibility, provision for load growth, and other desirable features. There may be some constructional detail, however, that destroys the effectiveness of a lot of this planning. For example, in some instances most of the cable will be run through one manhole, with no fireproofing or other steps taken to prevent a cable fire in the manhole from causing an outage in the entire plant—an outage that will last for some time because the fault cannot be quickly repaired.

It is important, therefore, to watch the physical arrangement of circuits and keep them separated, particularly those that are alternate to each other.

When selecting electrical distribution equipment, keep in mind that the use of factory-assembled apparatus will help to keep costs down. This equipment is fabricated and wired at the factory, and shipped assembled as a unit or in sections. Hence it requires only the lining up of major sections, and connection to the terminals in the field.

Studies of industrial power systems have shown that substations in the range of 750 to 1000 kva. are most economical for general industrial plant distribution, when using a 480-volt secondary. This selection of size of substation is substantiated by Figure 3, which shows the over-all system cost as a function of size of load-center substation.

Paper Is Still Needed

Even though the war is won, the need for paper conservation continues. Reconversion will require as much paper as has been used in shipments of medical and military supplies. Nothing can be shipped in this country or abroad without it.

Make Maintenance Easy

Consideration must be given to the location of electrical equipment in an industrial plant. Circuit breakers, for example, should not be installed in extremely dirty atmospheres, which would necessitate their frequent cleaning. In general, it is better to locate switchgear indoors, where both maintenance and emergency switching operations can be conducted independently of weather conditions. It is oftentimes found uneconomical, however, to put substation equipment indoors. In such instances, it is of necessity located outdoors, as Figure 6 shows.

Adequate maintenance schedules ought to be set up in the planning stage of any industrial electric power system. To get the most out of good equipment, it must be properly maintained. There must be periodic maintenance and checking of breakers, relays, transformers, and other parts of the system.

Make provisions in the design of the system to permit maintenance of these parts without dropping essential load.

In areas where continuous service is required, duplicate circuits must be provided so that maintenance can be carried on without dropping the load. In other instances where only some of the load is essential, provision may be made for carrying the essential part of the load during the maintenance period.

The foregoing are some of the more important points to be considered when designing a power system for a new factory, or when modernizing a power distribution system in an existing plant. It is very important that all these factors should be weighed in their relation to each other and the system planned as a coordinated, integrated unit, and not as several pieces of equipment thrown together to make a system.

Clean Equipment Safely

W. H. EASTON, Vice-President, Safety Research Institute, New York

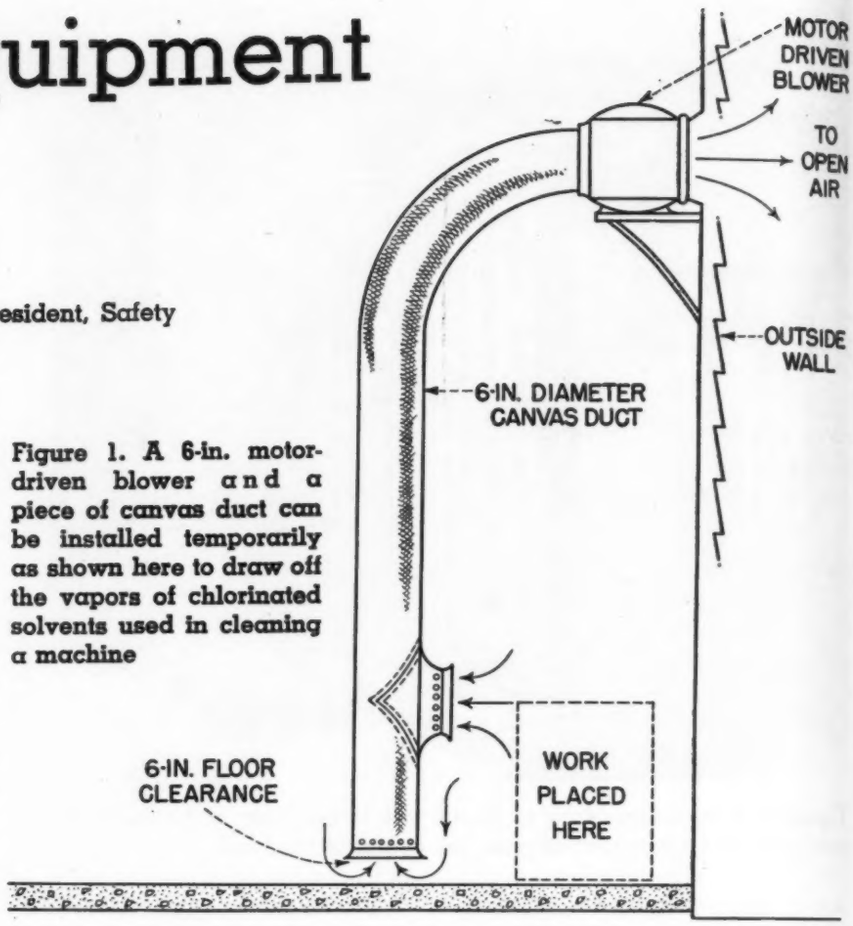


Figure 1. A 6-in. motor-driven blower and a piece of canvas duct can be installed temporarily as shown here to draw off the vapors of chlorinated solvents used in cleaning a machine

IN CLEANING MACHINERY, considerable quantities of organic solvents are commonly employed for removing grease and oil from bearings and other parts, as well as for removing the slushing oil or paint that was applied to bright surfaces for rust prevention. All organic solvents are hazardous to health in some degree, and some are also flammable. Safety, therefore, must always be insured whenever solvents are used. Too often, special jobs are undertaken without regard for many of the precautions that are normally observed. In consequence, a high proportion of accidents occurs when men are doing work outside their regular routine.

With reconversion, a great deal of formerly used machinery will be brought out of storage and cleaned up for replacement in service. The safeguards that should be adopted in cleaning machinery with solvents will vary with the job to be done and the solvent used.

The Hazards Involved

The so-called chlorinated solvents ordinarily used for machinery cleaning include carbon tetrachloride, trichlorethylene, perchlorethylene, and a 50-50 mixture of trichlorethylene and ethylene dichloride. Trichlorethylene has been assigned a flammability rating of 1 to 2 by the Underwriters' Laboratories and the trichlorethylene-ethylene dichloride mixture a rating of 5 (ether has a rating of 100 and carbon tetrachloride a rating of 0). Both are therefore fire hazards of very low order. Carbon tetrachloride and perchlorethylene are, of course, non-flammable.

In handling these solvents, therefore, the hazards that need to be guarded against are inhalation of the vapors, and skin contact.

The petroleum solvents generally used for machinery cleaning are gasoline, benzine, petroleum ether, and similar solvents with flammability ratings as high as 100, and kerosene and other such solvents with flammability ratings of about 40. In handling the petroleum solvents, therefore, fire hazards as well as health hazards must be considered.

Ethyl gas (gasoline containing the highly toxic tetraethyl lead) presents special health hazards, and is unsuitable for use in cleaning.

In many instances good ventilation around the work will afford adequate protection for the workers, but the method of securing such ventilation depends upon conditions.

It is best to have the cleaning done where equipment has already been installed to remove solvent vapors, as in a spray booth or some other especially well-ventilated space.

Handling Solvent Vapors

Where suitable ventilating facilities are lacking, and the cleaning job is of considerable magnitude, it is often advisable to install special means for handling the solvent vapors. Two suggested arrangements, which probably cost less than $150 each, for handling the vapors of chlorinated solvents are shown in the accompanying illustrations. These layouts are unsuitable for handling highly flammable vapors. If the vapor around the work should become ignited, the worker may be involved in the fire and the vapor-air mixture in the exhaust ducts may explode.

Figure 1 illustrates a method of removing solvent vapors from a large piece of machinery while it is being cleaned. A 6-in. motor-driven blower (not a propeller-type fan) draws contaminated air through a canvas duct from the breathing level and also from the floor level, where the heavy vapor tends to collect. Since the duct is flexible, it can be arranged to suit the work in hand. The blower must not exhaust into an area where people will be affected by the discharged vapor.

Atmospheric Survey

Freedom from a pronounced odor of the solvent at the breathing level around the work is an indication that the device is operating properly, but for complete assurance of safety an atmospheric survey must be made. This work requires the services of a competent chemist. In some states and cities the Industrial Hygiene Department undertakes such service for industrial plants on request.

Figure 2 shows an arrangement for cleaning small parts. The worker, with only his hands inside the hood, is protected from inhaling the vapor.

Wherever the cleaning job to be undertaken is of sufficient magnitude to require the installation of such equipment, it is advisable to consult a degreasing expert.

When the clean-up job is so small that the installation of special ventilating equipment is not warranted, it may be possible to take advantage of natural ventilation. Thus, a limited amount of cleaning can often be safely done by standing to the windward of a stiff breeze out of doors or in a strong draft from open windows, taking care that the draft does not blow the vapor toward other workers.

Gas Works Required

If workers unprotected by adequate mechanical ventilation have to handle solvents in large quantities, however, or for long periods of time, or in closed spaces, they must be provided with gas masks of a type approved by the U. S. Bureau of Mines for protection from the solvent being used. Respirators that protect only from dust and fumes are useless for this purpose. Workers in gas masks should always be supervised to make sure that they do not slip masks off while at work.

When gas masks must be worn by machine cleaners, other persons in the vicinity of the work will be endangered. Such work should, therefore, be done either in a vacant room or during off-hours.

Certain workers are adversely affected by low solvent-vapor concentrations that are harmeless for normal people. If any of the workers assigned to the clean-up job appear to be hypersensitive to solvents, they must be immediately assigned to other work.

In cleaning bright parts with clorinated solvents, it is well to use mixtures containing from 2 to 5 percent of light machine oil; otherwise the surfaces will be left completely dry and subject to corrosion. Solvent vapors, like moisture and some of the impurities frequently found in industrial atmospheres, are quite likely to cause corrosion of unprotected polished metal surfaces.

Hence, cleaning work should not be done in the same room with fine machinery unless the vapors are promptly removed by a ventilating system.

Danger of Skin Injury

The skin of most persons will be injured by continual contact with any of the commonly used organic solvents. In machinery cleaning operations direct handling of the solvent ought to be avoided if possible; otherwise, provide some protection for workers' hands.

Gloves made of material that resists the solvent being used afford the best protection, but some workers find the use of gloves objectionable. In such instances the hands and arms may be covered with a suitable protective cream. Glycerine, which is insoluble in many organic solvents, forms an excellent protective lotion in most cases.

After work, the hands may be cleaned with a mild soap and, if necessary, an abrasive that softens in water, like corn meal. An ointment consisting of half cold cream and half lanolin may then be applied to advantage.

Vapors of low flash-point solvents—those with Underwriters' flammability ratings as high as 100—if ignited by any flame or spark, will explode if their concentration in air lies between 1.3 and about 6 percent and will burn if their concentration is greater than 6 percent.

Rigid Control a "Must"

Since these solvents volatilize rapidly, a worker using them for cleaning machinery is likely to be surrounded by a dangerous atmosphere. In addition, the vapors spreading from the point of use tend to form low-lying invisible streams that have been known to flow into adjoining rooms or down stairways, become ignited, and flash back to their source.

It is difficult to eliminate all possible sources of ignition of these vapors from the vicinity of operations such as machinery cleaning. Fires and explosions of flammable solvents have resulted from such causes as broken electric lamps, sparks emitted by metal scraping on metal, and static sparks generated when surfaces are rubbed with solvent-soaked cloths in dry atmospheres.

Gasoline and other low flash-point solvents, therefore, can be safely used only where all conditions can be kept under rigid control.

High flash-point solvents—those with Underwriters' flammability ratings of about 40—are useful for cleaning bearings and removing grease and oil from other parts, but not for all phases of machinery cleaning, such as stripping off rust-preventing paint.

They are less hazardous than the low flash-point solvents because they volatilize more slowly. They can be handled safely if kept in safety cans and away from all sources of ignition but, once ignited, they may burn viciously. It is therefore advisable to use them in areas where fire would cause no serious damage.

If flammable solvents are to be used where there is no built-in fire protection, such as is often found in spray booths, keep fire extinguishers of suitable types in the vicinity of the workers doing the cleaning. It may even be desirable to station watchers with extinguishers nearby.

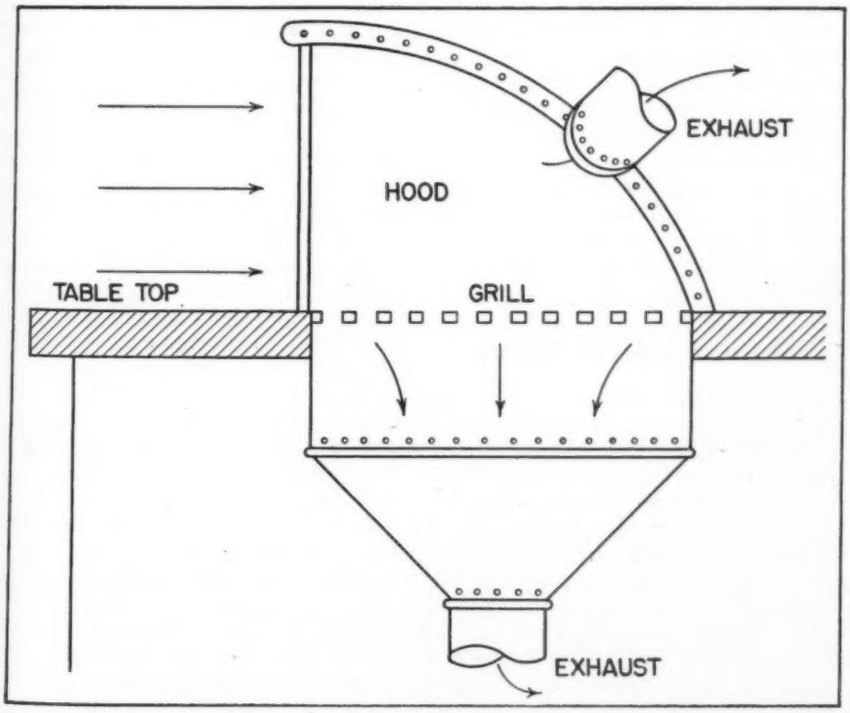


Figure 2. Small parts may be cleaned safely with chlorinated solvents by placing them on a grill that is set in a table and is surrounded by a hood with top and bottom exhaust ventilation

Snow Removal Methods That Keep Plants Open

JAMES MONTAGNES
Canadian Correspondent, *Factory*

Problem of snow removal at Canadian aircraft factories includes clearing deep snow from flight-test runways and taxi strips in addition to keeping all roads open for public transportation

PROMPT REMOVAL OF SNOW, although only a seasonal and irregular problem, sometimes becomes by necessity the most important job of a plant maintenance department. It can determine whether that plant is to operate fairly normally and well-staffed during and immediately after a bad snowstorm, or lacking it, whether many productive man-hours are to be lost because material cannot be moved as needed and workers cannot get to the plant on time or at all.

The responsibility of planning for snow removal is therefore similar to that for the provision of plant standby equipment for power failure or fire protection. Economically, the investment cost of snow-removal equipment would seem to be equally justified.

Snow removal techniques in eastern Canadian industrial plants have had to be developed to a high degree of efficiency because of known climatic conditions involving extremely heavy and crippling snowfalls. The experience of some of these plants in snow removal therefore should be of value to plants in the United States facing this same problem.

Record snowfalls during the winter of 1944-45 showed that most factories on the outskirts of large metropolitan areas in eastern Canada were prepared, as part of their maintenance work, to keep open the roads both to their plants and within the factory areas, and to keep parking lots cleared of snow. For this work, these factories had ready their own snow removal equipment, and also had arrangements with local contractors for rental of extra equipment to take care of any abnormal snowfalls that might occur during the winter.

Production the Thing

Of particular interest is the fact that all plants on the outskirts of populated areas were primarily concerned in keeping factory production at maximum, and therefore did not quibble with county, municipal, or provincial highway authorities as to whose job it was to keep roads into the factories cleared. The factories supplied the men and equipment to clear the highways leading to the plants from the main urban transportation hubs. It was not unusual during severe snowstorms, for instance, to find factory-owned or rented snowplows clearing as much as 5 miles of highway leading from city bus and streetcar lines into these plants. In this way buses as well as private cars of employees could get into the plants and keep day and night shifts going. During the worst snowfalls early in the winter, when more than 2 feet of snow fell in a single storm, maximum time lost by productive workers amounted to only three shifts.

Taking specific plants as examples of how snow removal problems were handled, the Victory Aircraft Limited, Malton, Ontario (making Lancaster four-engined bombers) kept nearly 10 miles of road and taxi strips, as well as the parking lot, involving an area of more than one million square feet, free of snow during the past winter. This company has had at hand one bulldozer to keep plant roads open and to maintain fire protection between buildings. During the heavy snowfalls it rented a scraper-carrier of 12-cu.-yd. capacity for clearing the parking lot, which measures 344,400 square feet. In the open areas the scraper-carrier moved back and forth, taking the snow away without transferring it to trucks. The company's bulldozer cleared the spaces along the fence and demarcation lines.

Powerful tractor-type snowplow is used all winter at the General Engineering Company's plant near Toronto to keep clear 4 miles of highway so that employees' cars can reach plant

Flight-test aprons and taxi strips of this company took longer to clear after record snowstorms. It was done with rented scraper-carriers and graders. Bulldozers cleared all main plant roads and service roads. Outside storage areas were cleared after the factory was in complete operation. Small areas not accessible to large equipment were cleared by hand and trucks. During the worst storms the company used 2 bulldozers, 1 grader, 2 scraper-carriers, 3 dump trucks, and employed 25 men to load trucks and shovel snow.

Another aircraft plant in the Toronto area, the De Havilland Aircraft of Canada Limited (making Mosquito twin-engined bombers and fighters) kept roads from the factory to the city cleared at all times, using 7 bulldozers, 2 graders, 4 rotary snowblowers, 2 side plows, 1 crane, and 15 trucks. It also had to keep clear a parking area for 1300 cars, plus 4 miles of runways and taxi strips, 2 miles of backroads into the plant, as well as all intraplant roads. To get employees into the plant it arranged for extra bus service from the city during the worst snowfalls, and had snowplows travel ahead of the buses to keep the roads constantly cleared. Equipment was

Rotary snowblowers at De Havilland Aircraft of Canada, Limited, help to keep roads and aircraft runways clear all winter

For small areas and walks around industrial plants, which are not accessible to mechanical snow removal equipment, the maintenance department must still rely on hand shoveling snow into dump trucks

rented from contractors or borrowed from Canadian Air Force stations.

An ammunition plant outside Toronto, operated by the General Engineering Company (Canada) Limited, kept 4 miles of highway cleared from the plant to the streetcar line from the city, enabling at the same time some 400 private cars of employees to bring in workers.

As an example of what was done by a plant of long standing outside the Toronto city limits, the Goodyear Tire & Rubber Company of Canada Limited relied on its own snowplow and trucks to keep road open into the plant from the main highway and streetcar line. Since all manufacturing departments in this plant are in one building, there were no plant roads of any length to keep clear. The parking lot on the property, which accommodates 300 cars, also had to be cleared.

At the Cockshutt Plow Company Limited, Brantford, Ontario, making agricultural machinery and aircraft components, the company attached snowplows to its own manufactured tractors and trucks to keep open its plant roads and a parking area for 100 cars. It also kept adjacent parking lots cleared for employees' cars. This procedure is typical of smaller plants located in small towns.

Ready for Anything

In all these cases the element of preparation to insure adequate snow removal equipment for all eventualities is predominant. To keep plants working at maximum output, practically all major Canadian factories have found it necessary to own some snow removal equipment and to prearrange with contractors for rental of additional equipment for use in severe snowstorms. For most snowstorms in eastern Canada, snowplows mounted on heavy-duty trucks have been found capable of removing snow up to a depth of 8 inches. For heavier snowfalls, bulldozers and rotary snowblowers are used.

The speed with which this heavy equipment can remove snow is shown by figures from Victory Aircraft Limited, Malton, for a storm that dropped 2 feet of snow overnight in the area. During the storm the company's own bulldozer was kept in operation for the express purpose of keeping plant roads open in order to maintain fire protection. Shortly after noon of the day following the heavy storm, a rented bulldozer was put to work, and at 7 p. m. the scraper-carrier joined the bulldozer in clearing the parking lot. It was cleared in time for the late night shift of that same day.

Additional equipment, as already described, was rented to help clear the entire area of one million square feet of roadways and taxi strips at this plant. This job required six days, using the equipment for 665 hours, while 25 men shoveled and loaded trucks for a total of 1424 hours.

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Unit Heaters and Ventilating Equipment

Unit heaters and ventilating equipment introduced to you by *Factory* during the past 12 months are reviewed here to give you a quick one-year summary

AXIAL FLOW FANS—Type B axial flow fans are for general ventilating and air conditioning service. Welded steel wheel is used, with large hub and varying blade pitch, to give uniform air flow over blade. Large hub prevents re-entry losses. Fans are belted or direct-connected, in capacities up to 45,750 c.f.m., and pressures ranging up to 1½-in. static. Buffalo Forge Co., Buffalo. (Figure 1)

CIRCULATING FAN—known as Reco Model No. 2061, is for ceiling mounting to secure even distribution of heat, thereby saving fuel. Fan has 24-in. diameter propellers, and can be adjusted to blow in various directions. Has 115-volt, 60 cycle, a.c. motor, and uses 300 watts per hour. Reynolds Electric Co., Chicago 12. (Figure 2)

COOLING TOWERS—Mechanical-draft cooling towers of small and medium capacity are designed for either indoor or outdoor operation. Air propulsion unit in small towers consists of slow-speed double-inlet blower, for quiet operation. Cooling Equipment Div., Binks Mfg. Co., Chicago. (Figure 3)

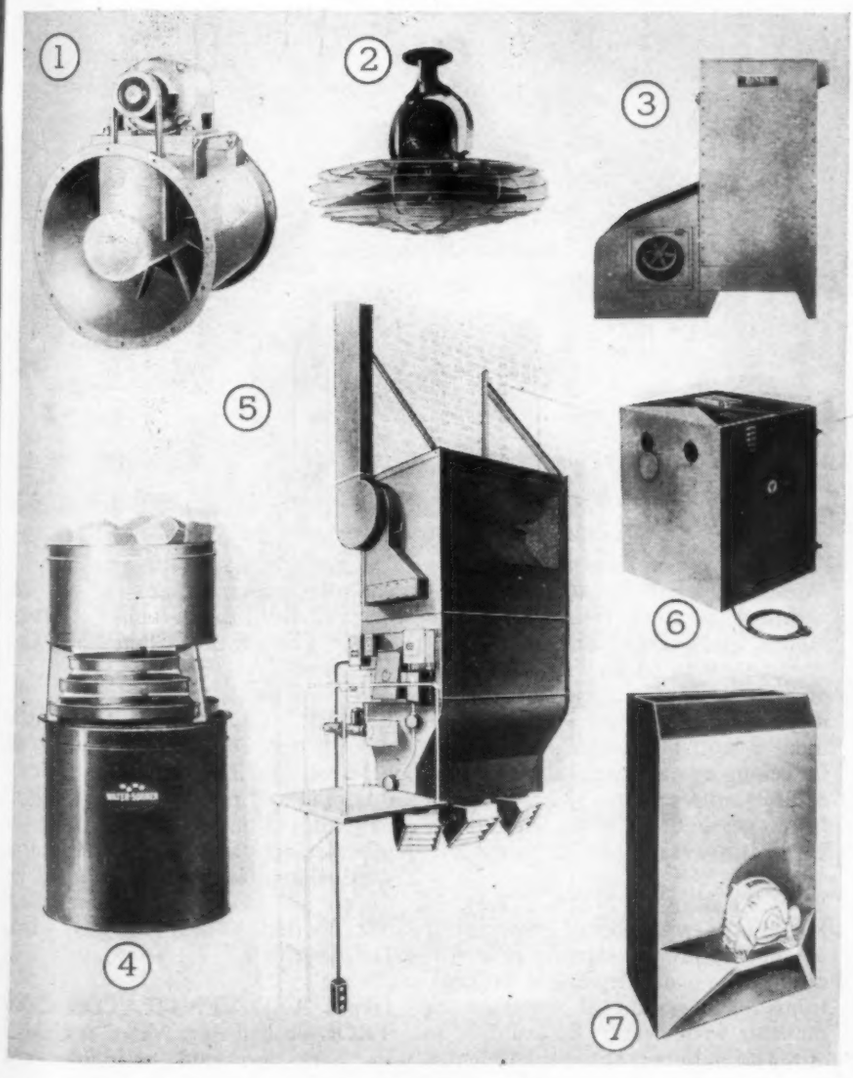
DEHUMIDIFIER—known as "Water-Sorber," is said to dry the air in warehouses, toolrooms, stockrooms, and other confined spaces, preventing dampness, mold, and mildew. A single unit is claimed to service from 800 to 1000 cubic feet. General Air Conditioning Co., Oakley, Cincinnati. (Figure 4)

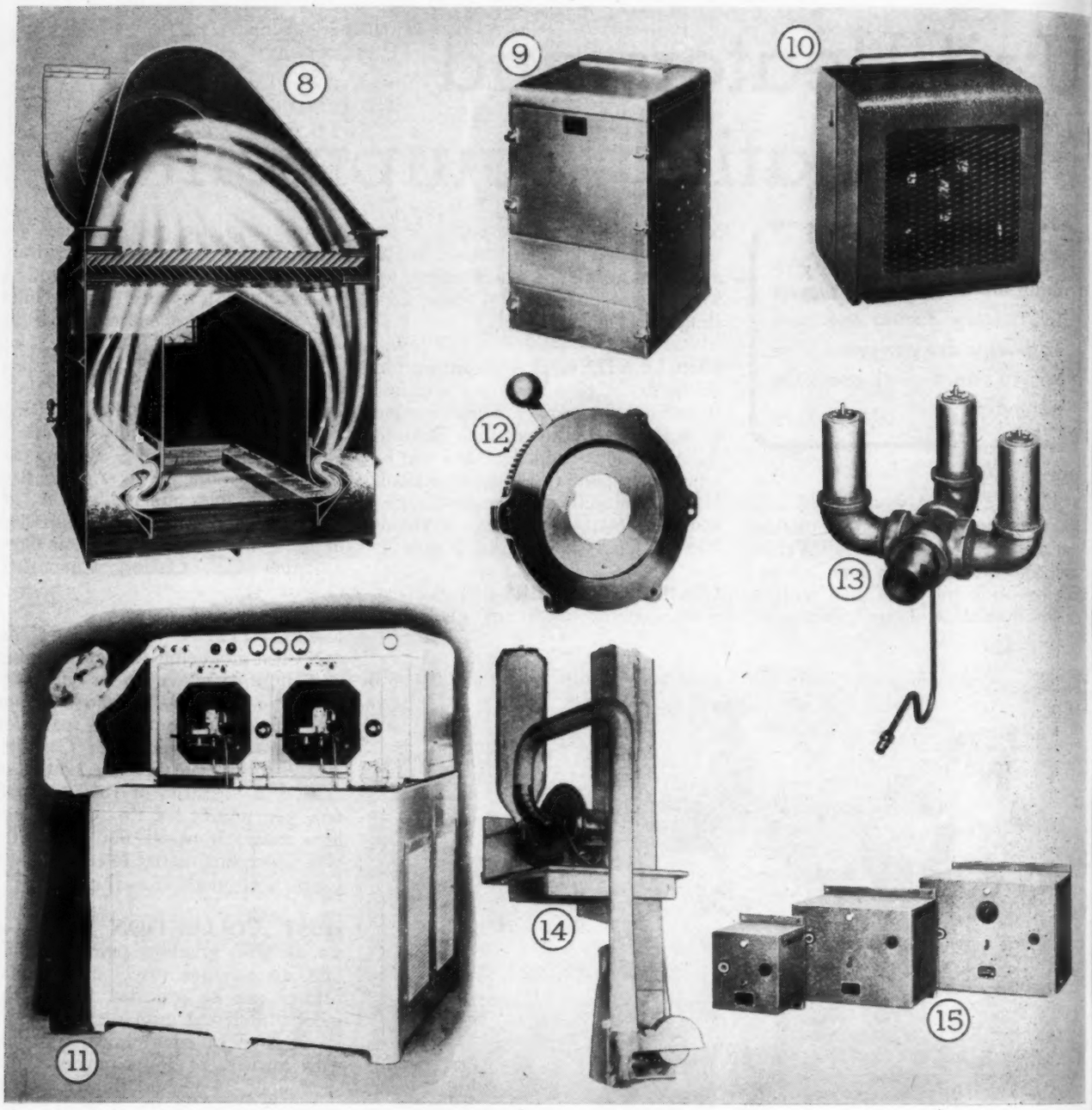
DIRECT-FIRED HEATER—Compact heat-producing and distributing unit, burning either gas or oil, is designed for suspension from walls or roof trusses, for use where space for floor units is not available. Can discharge warm air in any direction from nozzles at velocities of 1800 to 2000 feet per minute. B.t.u. output per hour ranges from 300,000 to 1,650,000, depending on size of unit. Dravo Corp., Pittsburgh 22. (Figure 5)

DUST COLLECTION UNIT—is for use with grinding, polishing, buffing, or sanding machines. Special fittings can be provided for attachment to different machine tools. Unit is activated by squirrel-cage type fan with capacity of 350 c.f.m. at static suction of 34 inches. Power is furnished by ½-hp. motor at 3450 r.p.m. The Delta Mfg. Co., Milwaukee 1. (Figure 6)

DUST COLLECTOR — Reducing the ratio of air volume to filter surface area, Tubular Dustex dust collector is claimed to collect and retain any type of dust or lint. Comes in 3 portable sizes, adaptable to requirements of buffing machines. Unit maintains static air pressure of more than 4 inches at a velocity of over 5000 l.f.m. Dust Filter Co., Chicago. (Figure 7)

DUST CONTROL EQUIPMENT—Type N Rotol-Clone is based on principle of hydrostatic precipitation. Requires minimum of space. Absence of moving parts is stated to make it





suitable for safe control of magnesium and explosive dusts, collection of linty and adhesive dusts and exhaust of corrosive gases. American Air Filter Co., Inc., Louisville 8. (Figure 8)

DUST REMOVAL UNIT—known as Dustex portable dust collector, is suitable for removing from the air dusts caused by grinding, buffing, polishing, and sanding operations. It is said to maintain constant static air suction of 3 to 4 inches at velocities of 4900 to 5600 l.f.m. depending on size of unit. Dust Filter Co., Chicago 40. (Figure 9)

ELECTRIC UNIT HEATERS—incorporate patented one-piece finned aluminum elements consisting of sheathed resistors cast within aluminum grids. Eight large sizes, ranging from 10 to 60 kw., are for ceiling or wall suspension, and six smaller models, from 1.5 to 7.5 kw., can be used as portable heaters or arranged for ceiling or wall suspension. Output of units ranges from 5122 to 204,900 B.t.u. per hour. Electric Air Heater Co., Mishawaka, Ind. (Figure 10)

ELECTRONIC INDUCTION HEATER—with normal frequency of 450,000 cycles and capacity of 20-kw. output, has two independent work stations for operation at the same or different frequencies. Accessibility to all subassemblies is obtainable. Manual controls for use during set-ups can be switched to automatic. Tocco Div., The Ohio Crankshaft Co., Cleveland 1. (Figure 11)

FILTER CLEANER—The Aktiv process for chemically cleaning all types of air filters, including air conditioning and engine, is said to eliminate use of materials that leave an offensive odor and are a fire hazard, as well as to shorten time required for the complete operation. Clean filter is left odorless. Turco Products, Inc., Los Angeles 1.

HEAT AND VENTILATOR CONTROL—called Aero Valve, is claimed to have corrosion resistance and

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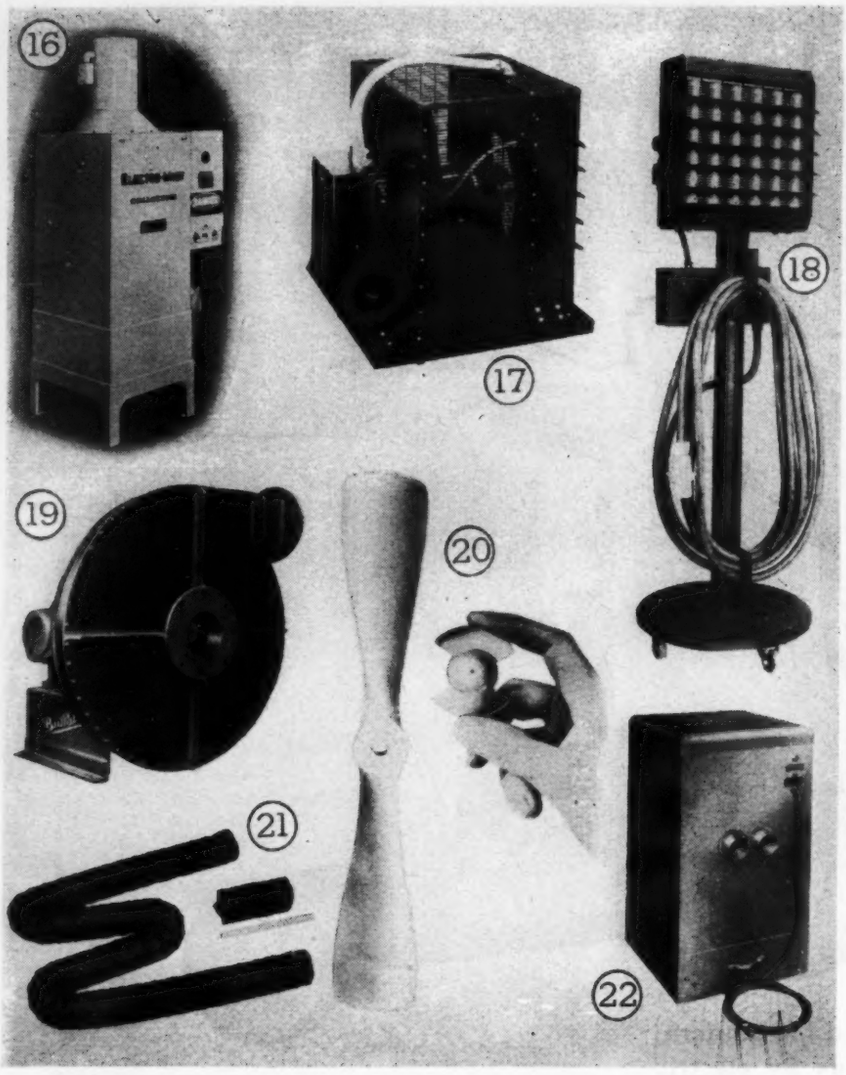
POWER

ARMY E NAVY

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto



strength for long, trouble-free operation for any air or heat control application. Has 36 control stages, and is constructed like a camera shutter. Smith-Mautz Co., Glendale 4, Calif. (Figure 12)

HUMIDIFIER—of cluster type, known as Skilbeck E-120, is available in multiples from 2 to 16 units, with capacity range from 240 to 1920 gallons per 24-hour period. Takes care of areas from 80,000 to 640,000 cubic feet of enclosure, and operates on pressures ranging from 1 to 20 pounds. Adaptable for use in air conditioning systems. Techtmann Industries, Inc., Milwaukee 2. (Figure 13)

INDIVIDUAL DUST COLLECTOR—Suction dust collection unit has a capacity of 600 c.f.m. when powered by a ¼-hp. motor operating at 3500 r.p.m. Can be used at individual grinding or polishing wheels, or similar dust creating tools. Operates from any electric light socket. Unit includes dust hood, 3-in. suction pipe and elbows, and 9-in. diameter dust collection bag. Leiman Bros., Newark, N. J. (Figure 14)

INDUCTION HEATING UNIT—"Megatherm" heating unit is said to be adapted to high-speed induction surface hardening of parts such as bearing surfaces, cam faces, gear-tooth contours, as well as to field of brazing and silver soldering. Uses frequencies between 2 to 5 million cycles per second. Overall efficiency is said to equal or exceed 50 percent, and power factor to be 95 percent. Federal Telephone & Radio Corp., Newark, N. J. (Figure 15)

OIL MIST FILTER—Electro-Mist is a demountable electronic unit designed to collect oil mist from high-speed cutting tools, or welding fumes in light concentrations. Operator is said to be protected from electrical shock because turning latches to remove panel effects short circuit of all charged parts. Power pack operates from nominal 115 volts 60-cycle, single phase. American Air Filter Co., Inc., Louisville 8. (Figure 16)

PORTABLE AIR HEATER—supplies heat at any location, or extra amounts at certain periods. Adaptable for heating emergency huts used to protect men working outdoors. Heater elements, fan motor, contactor, and switch are all mounted on one base with casters. Electric Air Heater Co., Mishawaka, Ind. (Figure 17)

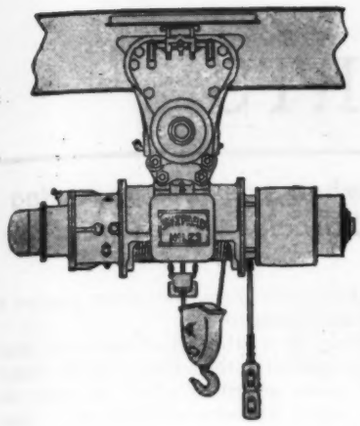
PORTABLE ELECTRIC HEATER—can be easily moved to working areas, and is adaptable for de-freezing coils in cold storage plants. Unit is furnished in various sizes. Electric Air Heater Co., Mishawaka, Ind. (Figure 18)

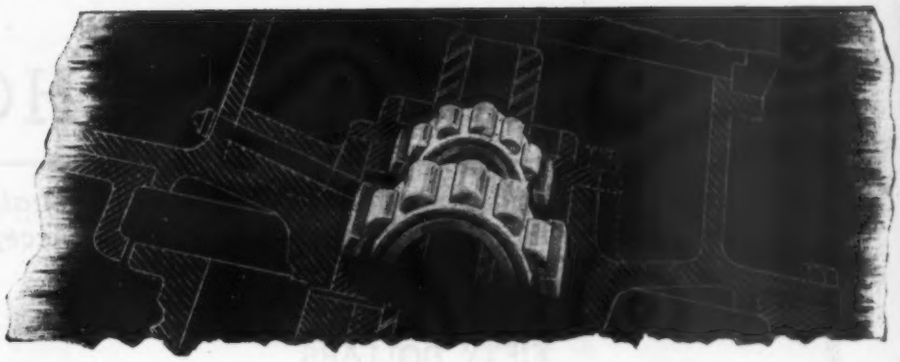
PRESSURE BLOWERS—Centrifugal blower unit, known as Type CB, has capacity range from 200 to 5000 c.f.m., and pressure range from ¾ to 2 p.s.i. Type CC compressor ranges from 4000 to 75,000 c.f.m. at pressures up to 4 p.s.i. Blowers are suitable for handling air for oil or gas furnaces, high pressure installations, and for other uses. Buffalo Forge Co., Buffalo. (Figure 19)

PROPELLER FAN UNITS—Two axial-flow fan units are for high and low pressures, ranging in propeller sizes from 2 to 60 inches in diameter. All fans are available in both single-stage and multi-stage varieties. Dynamic Air Engineering, Inc., Los Angeles 11 (Figure 20)

RETRACTABLE TUBING—is designed to meet industrial requirements for a portable duct connection for cold or heated air. Made of lightweight fabric, a 15-ft. length when retracted can be stowed in a 1-ft. container. When made of heavier material ratio is somewhat reduced. Manufactured in standard inside diameters of 4, 6, 8, 10, and 12 inches, and in 2- to 30-ft. lengths. The Wiremold Co., Hartford, Conn. (Figure 21)

UNIT TYPE DUST COLLECTOR—Standard attachments simplify installation of unit type dust collector on grinders, buffers, sanders, polishers, lathes, and other machines. Fits behind or beside machines. Develops 500 c.f.m. through two inlets by a ¾-hp., 3450-r.p.m. motor, driving 7½-in. diameter by 2-in. wide squirrel cage blower wheel. Filter consists of 20 layers of viscous coated filter paper. Ideal Commutator Dresser Co., Sycamore, Ill. (Figure 22)





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Prize-winning short this month, "Cleaner Unit Heaters Use Less Steam" on page 162

Testing Rubber Belts for Static Conductivity

SOURCE: The B. F. Goodrich Company, Akron

Static conductive rubber belts have proved especially valuable in many phases of war work, particularly in operations where a static spark might set off a fire or explosion. But they should be tested for conductivity at regular intervals of at least once monthly.

A simple assembly, using a 5- or 6-ft. length of lamp cord with standard rubber socket plug, a 2-watt neon bulb, two ordinary clamps or metal prongs, and two insulated handles can be readily constructed for the test.

One of the wires of the cord is cut, the neon bulb is inserted in a standard base, the insulated handles are installed near the end of each wire, and the prongs or clamps are attached to the wires.

To make the test, part of the belt or other rubber product is moistened with water, leaving a dry section 8 to 12 inches long between the moistened surfaces; the testing assembly is plugged into any 110-volt a.c. line; and the clamps or prongs are applied to the moistened surfaces, with the dry in the middle.

If the neon lamp glows, the rubber article being tested is static conductive

If the bulb glows, the rubber product is a static conductor.

The belt or other article under test must be suspended in the air between the clamping points, or rest on a table or other surface which has been insulated so it is non-conducting.

•

Quick Way to Repair Hose Joint Leak

H. B. McDERMID, Cincinnati

Here is a quick method of stopping a leak in a nipple-hose joint in a compressed air line: Take a short piece of light iron wire, double it, and pass it around the hose over the leaking joint. As an illustration, say the two ends are vertical, and the looped end just reaches past the standing parts. An 8-penny nail slipped through the loop makes an adequate lever. Three twists of the loop and nail around the standing part completes the job. It is a rather rough-looking job, but it makes the difference between an air tool's operating effectively or not, until a neater repair can be made.

•

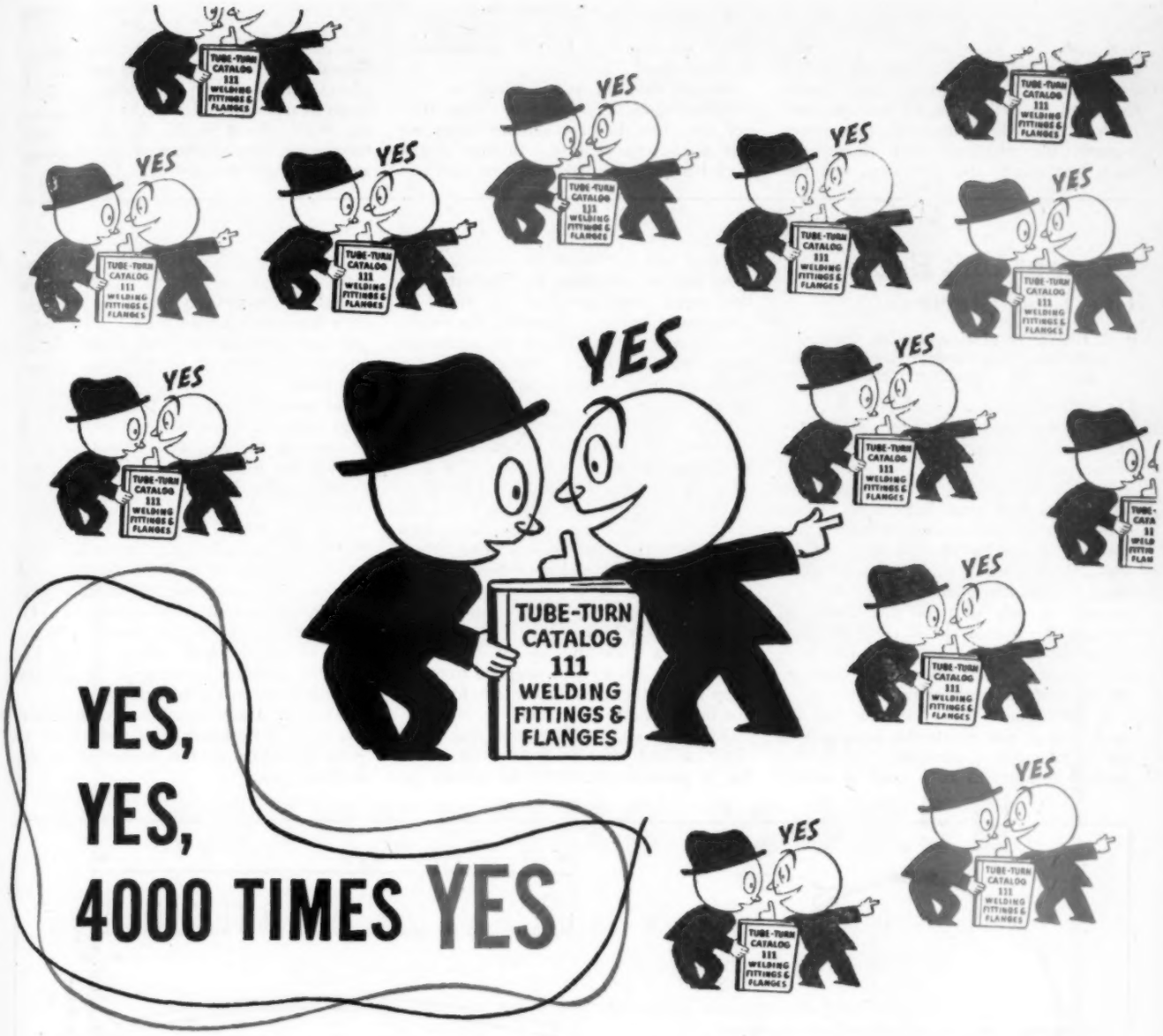
Suggestion Plan Peps Up Janitor Morale

W. A. RHODEHAMEL, Maintenance Superintendent, Curtiss-Wright Corporation, Propeller Division, Indianapolis

By giving the personnel of the plant sanitation department an opportunity to report unsatisfactory plant conditions not within their own province to remedy, the morale of these men has been rekindled so that they now take a renewed interest in their jobs.

Formerly, when conditions beyond their control created work they felt unnecessary, the sanitation employees, especially those in the manufacturing areas of this plant, felt as though they were working against a tide. Each man was responsible for the cleanliness of an assigned zone. But whenever a machine leaked oil on the floor, for instance, the outlook for keeping the floor clean became hopeless. Faced with frequent occurrences of this kind, the sanitation employee naturally became discouraged. The quality of his work suffered, and labor turnover became an added problem.

Adaptation to the sanitation department of the basic principles of the plant suggestion system, in simple form, brought about the change in sanitation employees' attitudes. Each employee has been given a loose-leaf pocket-sized notebook, with



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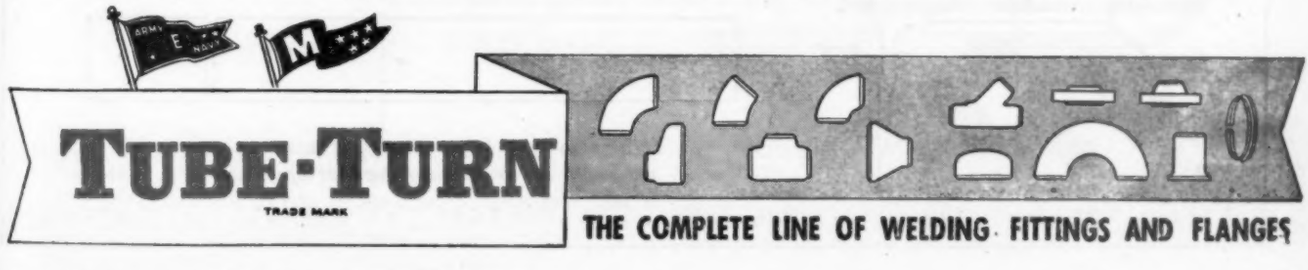


instructions to jot down all bad conditions in his area. These notes are turned over daily to his foreman, who checks them and passes them on to the supervisor of sanitation. This supervisor then issues requests for whatever work orders are needed to rectify the condition, and the orders are approved by the maintenance superintendent.

Because the sanitation personnel are now contributing ideas that are acted upon, they feel they have become a more important part of the organization. Interest in the work has been aroused, initiative has been stimulated, and morale is at a high point. Reports are now received to improve all phases of housekeeping, covering such items as repairing holes in the floor, painting lines. As a result, far better janitorial work is being obtained, and the men are happy and satisfied.

Cleaner Unit Heaters Use Less Steam

H. C. HICKS, Plant Maintenance, Ordnance Division, Otis-Fensom Elevator Company, Ltd., Hamilton, Ont., Canada

Development of a better method of cleaning unit heaters is saving from 20,000,000 to 30,000,000 pounds of steam during the heating season.

In this plant there are 250 projection-type, down-draft unit heaters of various sizes. During the summer months these units are operated to circulate the air. Consequently when the time comes to clean them in the fall, there is a considerable amount of oily dust on the face and through the fins of the heating coils.

For the first two years, these unit heaters were cleaned by vacuum, after brushing off the heavy deposits of dirt.

A better method of cleaning was desired, and it was eventually developed by the maintenance department. With this method compressed air is used to remove the dust and dirt from the heating coils.

As will be seen from the illustration, a thin metal band or shield was made for each size of heater. This band fits loosely enough around the heater to permit its being rotated easily. The ends of the band are held together by a couple of simple catches.

Three simple handles are welded onto the band. It carries also a standard female air fitting, screwed into half of a ¾-in. coupling that was welded to the band.

The procedure is as follows:

There are three men in the crew. Two work from the roof trusses, from which the heaters are suspended. The other man stays on the floor.

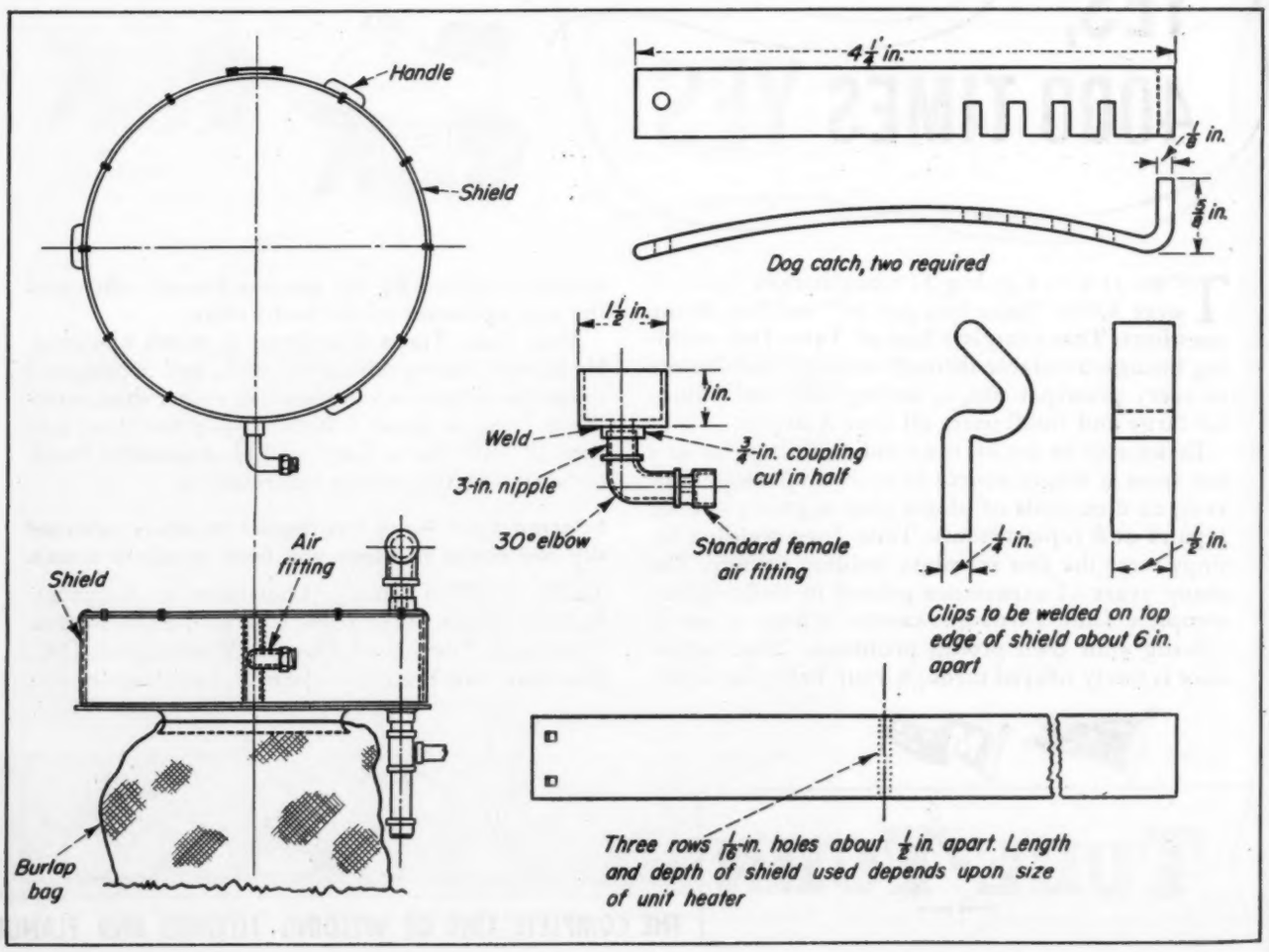
The men overhead put the shield around the heater. A burlap bag is attached by means of a drawstring to the bottom of the heater. An air hose supplied from the shop line is then attached to the fitting in the band around the heater.

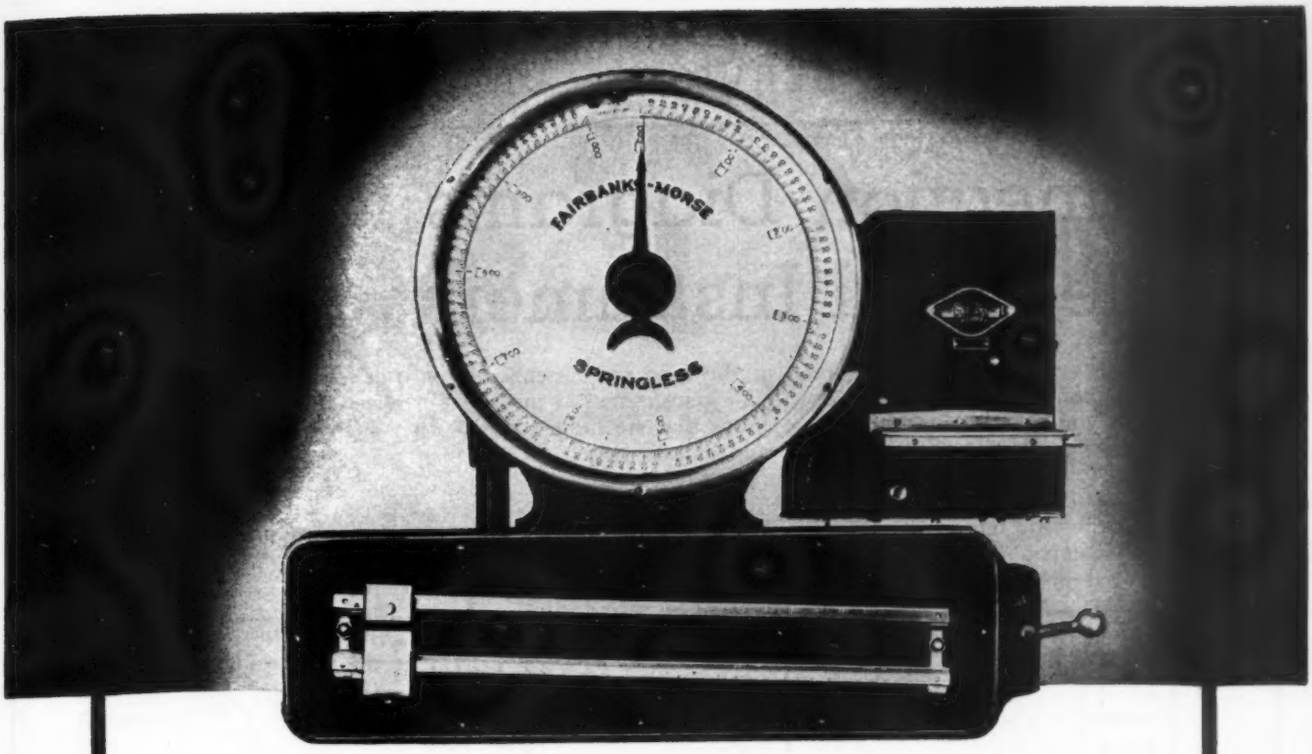
The man on the floor starts the down-draft fan and turns on the air line, which has a pressure of 80 to 90 pounds per square inch. Then the two men overhead begin to rotate the shield with a to-and-fro motion until the fin surfaces have been completed covered. The average time required to clean a unit heater mounted 22 feet above the floor is one-half hour.

As mentioned before, there has been a large saving in steam since the new method of cleaning the unit heaters was adopted. During the heating season 1941-42, total steam consumption was 80,733,200 pounds, while it was 86,359,200 pounds during the 1942-43 season. In 1943-44, 59,961,000 pounds were consumed, with 54,653,200 pounds in 1944-45.

Average consumption of steam for the two heating seasons, 1941-42 and 1942-43, therefore was 83,546,200 pounds. In the 1943-44 and 1944-45 seasons it was 57,307,100 pounds, a saving of 26,239,100 pounds between the two periods.

The unit heaters usually are cleaned near the end of September, to put them in good condition at the beginning of the heating season.





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Connection Diagrams for Electrical Instruments

BELOW and on page 166 are shown the connection diagrams for some of the electrical measuring instruments commonly used in industrial plants on power circuits. While the method of connecting some of the individual instruments presents no problem, the use of several instruments at one time or the need for current and potential transformers, involves connections that are more complicated and easy to forget.

Correctness of instrument connections is essential for two reasons: (1) To secure correct results from the measurements that are being made; (2) to prevent possible damage being done to delicate and expensive equipment.

When in use electrical measuring instruments should always be properly protected by fuses, although in order to keep these diagrams as simple as possible such protection has not been indicated on them.

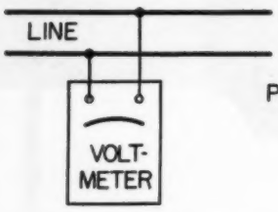

Figure 1. Measuring voltage in a d.c. or a.c. circuit when the voltmeter can be connected directly

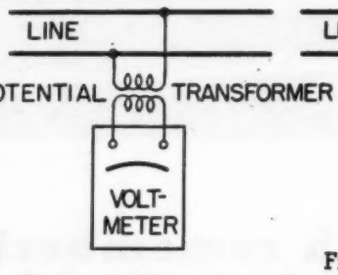

Figure 2. Measuring voltage in an a.c. circuit when a potential transformer is required

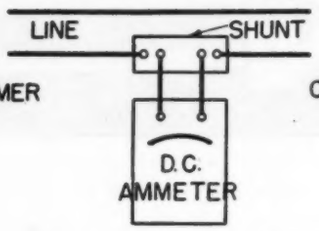

Figure 3. Measuring current in a d.c. circuit when the ammeter is provided with an external shunt

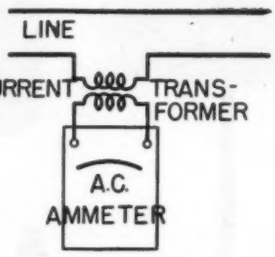

Figure 4. Measuring current in an a.c. circuit when a current transformer is required

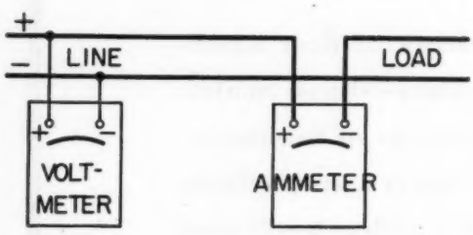

Figure 5. Measuring watts in a two-wire d.c. circuit with a voltmeter and an ammeter

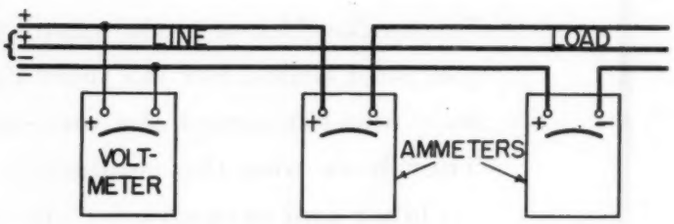

Figure 6. Measuring watts in a three-wire d.c. circuit with two ammeters and a voltmeter

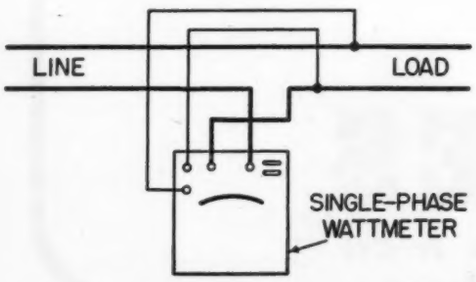

Figure 7. Measuring power in a two-wire d.c. or single-phase a.c. circuit with a single-phase wattmeter

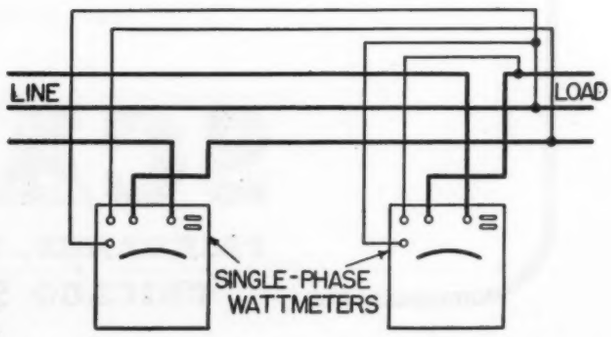

Figure 8. Measuring power in a three-wire d.c. or single, two, or three-phase a.c. circuit with two single-phase wattmeters

(*Continued on page 166*)

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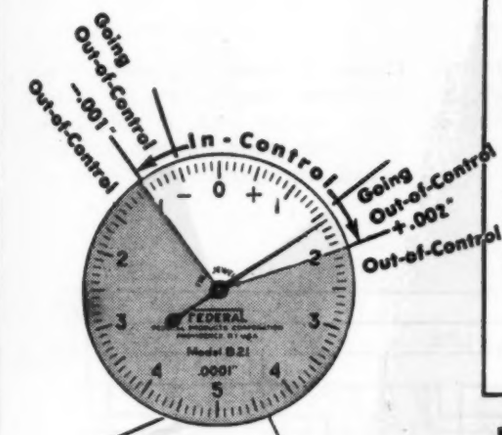

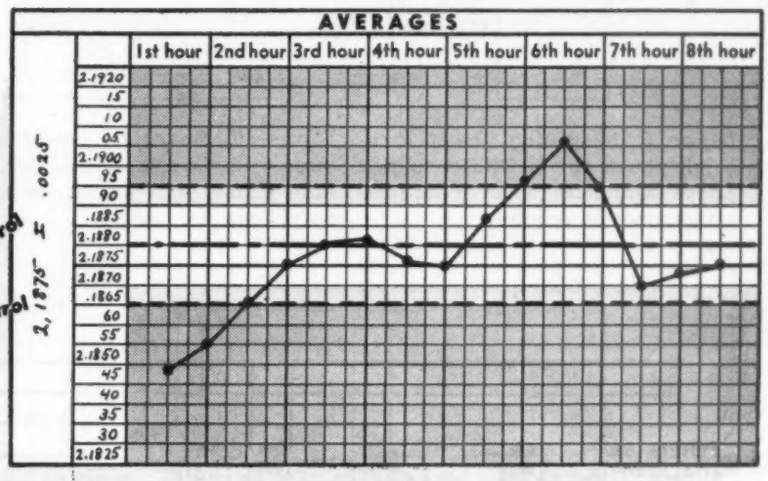

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PRECISION MEASURING INSTRUMENTS

Connections Diagrams for Electrical Instruments *(Continued from page 164)*

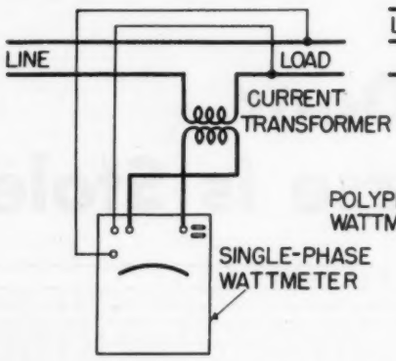


Figure 9. Measuring power in a single-phase circuit with a single-phase wattmeter when a current transformer is required

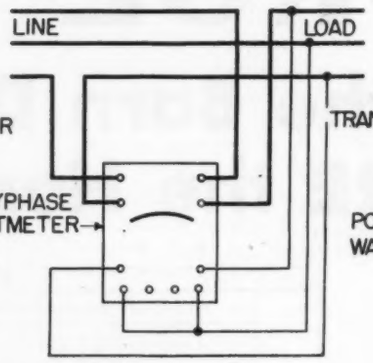


Figure 10. Measuring power in a three-wire d.c., or single, two, or three-phase a.c. circuit with a polyphase wattmeter

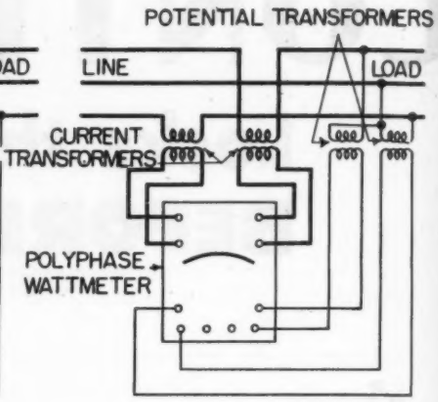


Figure 11. Measuring power in a three-wire, single, two, or three-phase circuit with a polyphase wattmeter when current and potential transformers are required

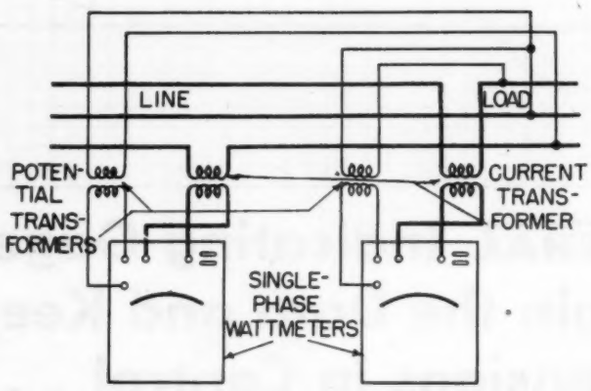


Figure 12. Measuring power in a single, two, or three-phase circuit with two single-phase wattmeters when current and potential transformers are required

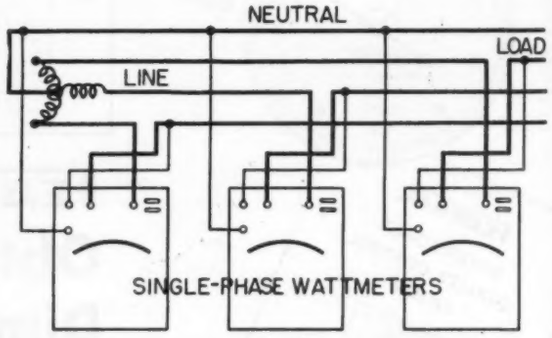


Figure 13. Measuring power in a four-wire, three-phase circuit with three single-phase wattmeters

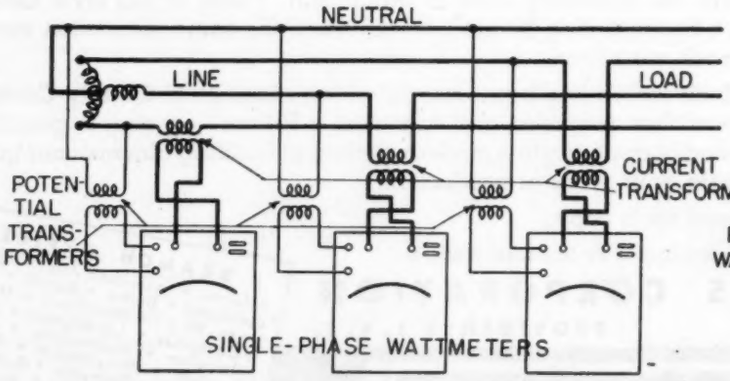


Figure 14. Measuring power in a four-wire, three-phase circuit with three single-phase wattmeters, using current and potential transformers

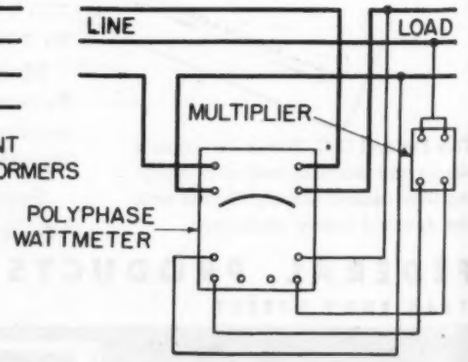
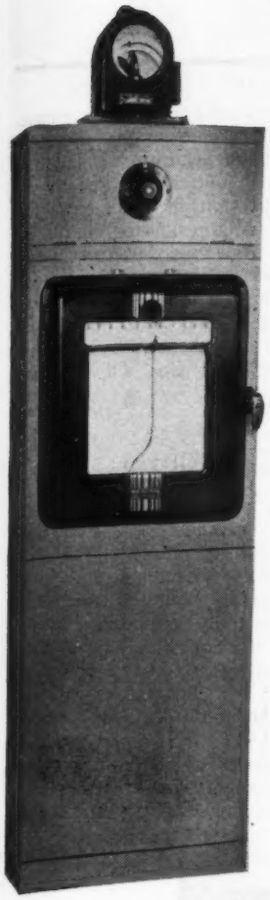
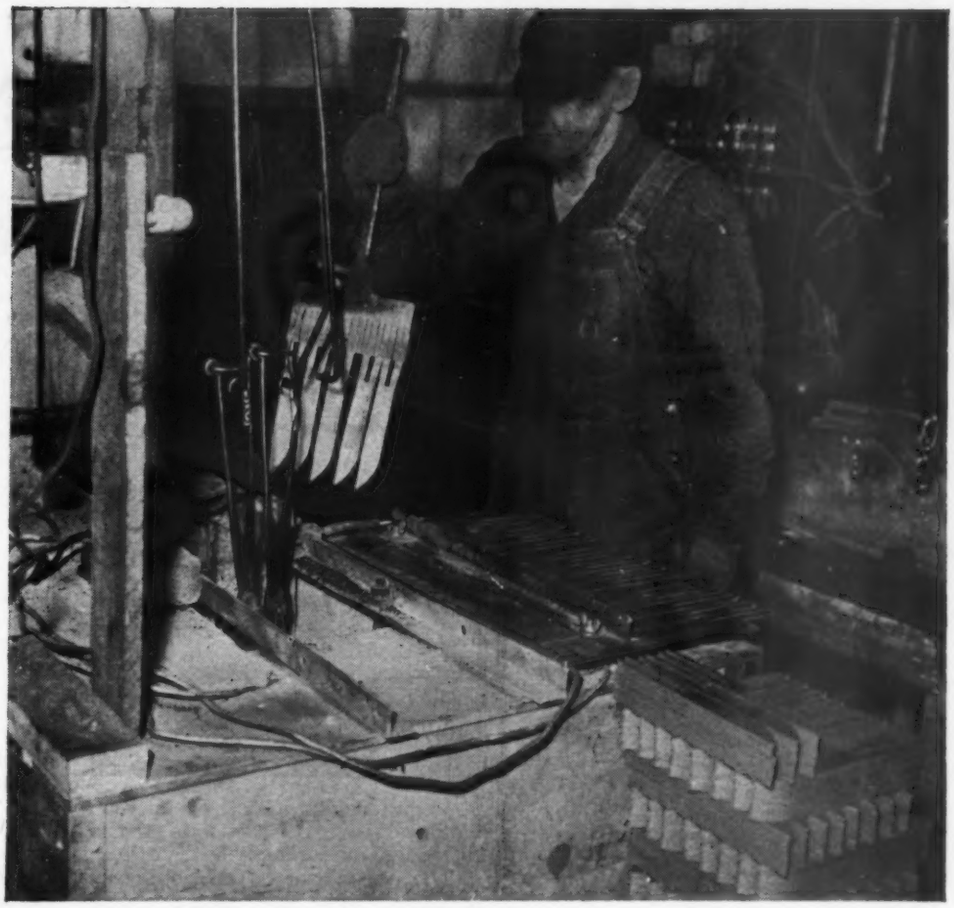


Figure 15. Measuring power in a three-wire, single, two, or three-phase circuit with a polyphase wattmeter, when a multiplier is used





Micromax Controller at left regulates the heating of knife blade forgings in the electric lead pot hardening furnace at Western States Cutlery Company, Boulder, Colo.

"MICROMAX Gives Dependable Heat-treats", says Maker of Combat Knives

"We were working 100% on production of knives for the Armed Forces," says Western States Cutlery.

"We use a special formula, high carbon cutlery steel for the blades which range from 3 to 15 inches long, ½ to 2 inches wide. The blades are hardened in batches in an electrically-heated lead pot furnace. They are manually racked and held in tongs for immersion.

"A Micromax Controller is used to control temperature in the lead pot. Replacing a millivoltmeter formerly used, this instrument gives a record of blade immersions throughout operating periods, and by its accuracy shows the quality of our heating control and hardening. *It assures us of dependable heat-treating jobs,* and we are profiting a great deal by having it."

A standard Micromax is adaptable to any furnace; can provide the on-off regulation described above, or proportioning control.

Catalog N-33A, "Micromax Thermocouple Pyrometers", gives general information about all Micromax Controllers. An L&N engineer will be glad to supply more individualized information, if you will outline your problem.

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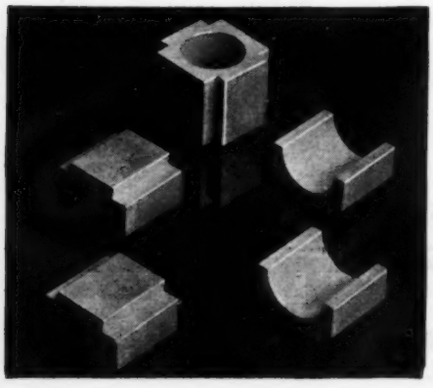
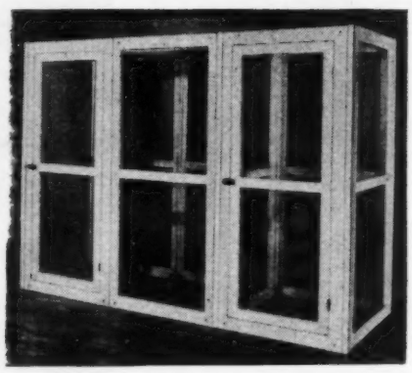


WHAT'S NEW IN EQUIPMENT

Portable Storage Rooms

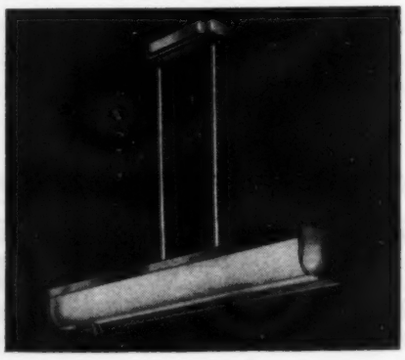
Designed to be set up anywhere for temporary or permanent storage of food, supplies, tools, and equipment, portable storage rooms can be installed as individual rooms or in batteries of adjoining rooms. Door panels are equipped with sturdy padlock-type hasp, and the rooms themselves



are complete except for padlock on door. The rooms are constructed with substantial wood frames 1-⅛-in. thick, mortised and tenoned, with all joints glued. Frames are covered with heavy galvanized wire screening. Panels interlock so that rooms or batteries of rooms can be quickly and easily assembled or dismantled without tools, screws, or nails. Complete units, with ceiling panels, are rat- and mouse-proof, as well as pilfer-proof, states the manufacturer. Rooms provide maximum ventilation and passage of light, and because they are light in weight can be moved easily, set up, or taken down by regular employees. Drinkwater, Inc., 2323 South Michigan Ave., Chicago 16.

Fluorescent Luminaire

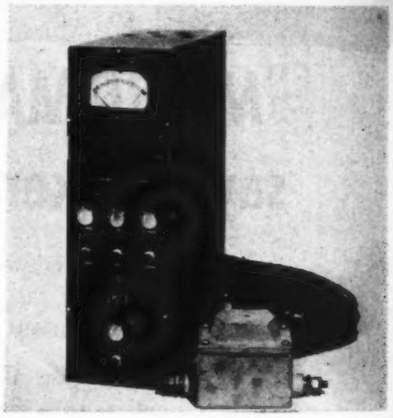
Utilizing two 40-watt T-12 fluorescent lamps, No. A-1240 Permaflector luminaire embodies Skytex Satinol diffusing ribbed glass side panels with curved lower halves, leaving opening at bottom for vertical baffle. Side panels are easily removed for servicing and maintenance. Fixtures may be installed directly against ceiling, or pendant mounted with stem hanger and canopy assembly, and may be joined end



to end to form continuous line luminaire. Reflector can be removed for inspection of wiring without disturbing ballast and other equipment, and is attached to top housing with two threaded cap nuts. Reflector, baffle, and top housing are formed without seams from single sheet of 20-gage steel. They are covered with heat resisting white enamel, and reflection factor is said to be at least 83 percent. Equipment is approved by Underwriters' Laboratories. Pittsburgh Reflector Co., Oliver Bldg., Pittsburgh 22.

Gas Alarm

Instrument is announced which detects presence of combustible gases and vapors, visually and audibly indicating their approach to the dangerous limits before a fire or an explosion might take place. Automatically ventilating fans may be started, or machinery may be stopped. Claimed advantages of the remote head gas alarm are: (1) Analysis of gas takes place in remote head and indication is instantaneous; (2) explosion-proof remote head can be placed in gaseous atmosphere permitting analysis of gases as they exist; (3) any number of analysis heads may be



employed and each may be calibrated for individual gases, with operation of entire unit taking place at one point; (4) filament blow-out signal gives operator visual and audible indication if any head is inoperative. The other heads continue to give protection. Approved by Associated Factory Mutual Laboratories. Davis Emergency Equipment Co., 45 Halleck St., Newark 4, N. J.

Coolant Strainer

Non-clogging coolant and cutting oil strainer for installation on grinders, lathes, and other machine tools, is now on the market. Known as Metex Model G, it is claimed to provide clean fluids and long periods of uninterrupted strainer service, prevent chips or particles from being recirculated in the fluids, and to

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Cutting speeds can't be as fast as with carbon steel or low alloys. Tools should be high speed steel or carbide-metal tipped, with a generous rake and a chip breaker, if possible. Keep them sharp, and don't allow the tool to ride on the work, to avoid work-hardening.

More important, check the design of the cutting tool itself, and check the possibility of using one of the special easy-machining grades of Allegheny Metal. Let us help you also to select the right cutting tool from our complete range of High Speed Steels, ALX Cast Alloy Bits and Carmet Carbide Tools.

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The tiny Bostitch staple... machine-applied... preformed or from a coil of wire ... speeds many fastening operations... in manufacturing, in paper work, in packing and shipping. A pottery manufacturer saved 50% in carton-sealing... a shoe manufacturer attached felt to wood heels 10 times faster... a softball manufacturer saved 70% in an important operation.

Investigate Bostitching — a growing production method—for fastening metal, plastics, wood, cloth, paper... in any combination... very often much faster, easier better than gluing, nailing, taping, etc.

Mail coupon for Folder B-154 which briefly covers representative models and may suggest an application that you can use to speed your fastening or lower your costs.

BOSTITCHING
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Experience... EST. 1896 Nearly 50 years specializing in fastening.

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Service... Over 200 local representatives, all stapling specialists (300 prewar, 400 postwar).

Bostitch Staples in most sizes are now available

BOSTITCH
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ALL TYPES OF STAPLES APPLIED BY MACHINES
ALL TYPES OF MACHINES FOR APPLYING STAPLES

BOSTITCH (Boston Wire Stitcher Co.), 76 Blackmore St., East Greenwich, R. I. (Bostitch-Canada, Ltd., Montreal).

Please send Folder B-154 on Bostitch time-and-money-saving applications to:

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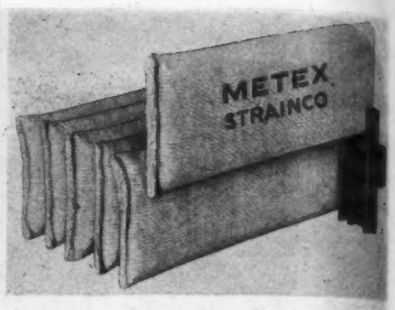


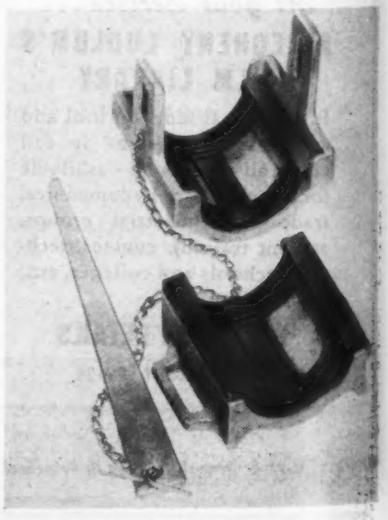
help avoid scoring or other defective work in machine operations. Constructed of knitted fabric and wire made into strong, non-collapsible rectangular units with high strainage area, the composite honeycomb mesh is fine woven to catch dirt, grit, and chips, and provides ample free area for passage of cleaned fluids. It is available in six sizes, surface straining areas, and capacities. Clean refills can be installed in the slots, and old strainers can be washed out. Strainer Products Corp., 75-77 North Willow St., Montclair, N. J.

Aluminum Stool

The No. 1318 stool, made of hard alloy aluminum, is 13 inches in diameter, 18 inches high, and weighs 2½ pounds. Device is non-sparking, and can be used in powder or chemical plants, as well as for other industrial applications. Castings on bottom of legs are brazed to make a ground connection so that no static electricity can develop. Available in a range of sizes. Can be cleaned by washing with soap and water—does not rust or otherwise corrode. The Aluminum Ladder Co., 122 Carbis St., Worthington, Pa.

Flexible Pipe Couplings

Fast coupling of pipe at low cost, with increased flexibility, is claimed for line of flexible pipe couplings, known as Presto-Lock. Can be used with any plain end pipe without threads, grooves, or flanges. No wrenches or special tools of any kind are required in assembly; only a hammer is needed to tighten wedge keys after the two sections are fitted over pipe ends and



Stepless **VARIABLE SPEED** operation offers tremendous advantages on many applications. And when you can vary the speed electrically, either automatically or by remote control push button, you not only add advantages . . . you multiply them.

For example, look at the power unit below. Designed for full automatic operation, it can be adjusted to operate on any predetermined duty cycle so that changes in speed can be made either rapidly or slowly, as required.

In many processes, such a power unit is very desirable for changing the speed automatically to compensate for changes in temperature, pressure, humidity, consistency, or size of material, or to synchronize with other operations.

Once adjusted, the operation requires little attention, so that one operator can easily take care of several machines. Result . . . a better quality product and lower labor costs.

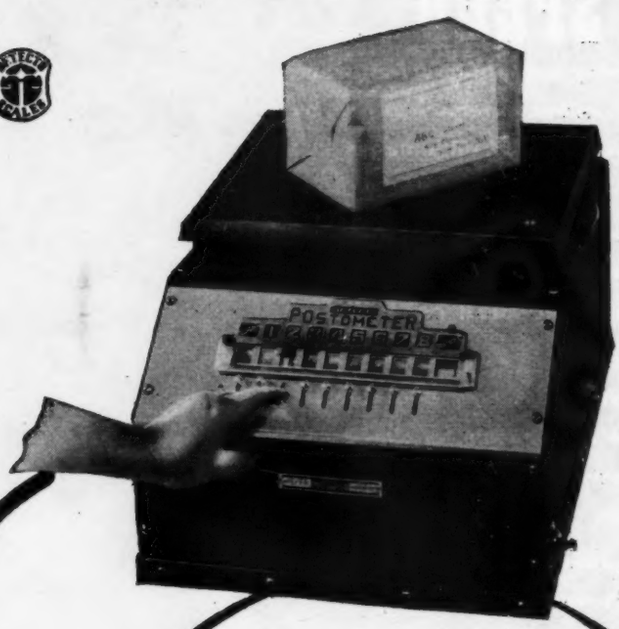
Yours may not be a job where full automatic operation is required, but controlled variations in speed by remote push button may add greatly to its efficiency and convenience.

Next time you need a drive for mixers, grinders or pulverizers, heat treat or baking ovens, automatic plating equipment, reeling devices, proportioning equipment . . . to name only a few . . . see what a really remarkable job Master Speedrangers with electric remote control can do for you.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

MASTER SPEEDRANGERS

DETECTO POST-O-METER



DETECTO ENDS GUESSWORK *in Postal Weighing*

Detecto Scales for industrial and commercial uses end guesswork in weighing — speed weighing operations — save time, money and reputation for the leaders of American industry.

No scale in the **Detecto** line illustrates this more than the Post-O-Meter, an automatic computing scale — sturdy, efficient, engineered to eliminate over-postage, zoning errors, "postage-due" delays. You simply press the right zone key and the CORRECT POSTAGE cost appears enlarged by a powerful magnifying glass. To double your shipping room efficiency get a **Detecto** Post-O-Meter—to end guesswork in every weighing operation throughout your plant call a **Detecto** Scale engineer today.

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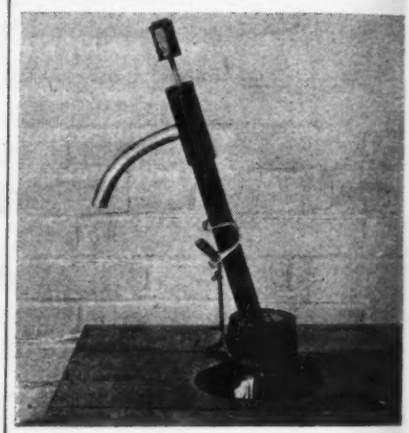
DETECTO SCALES, INC.
ONE MAIN STREET · BROOKLYN, N. Y.

keys have been inserted in key channels. Made in five sizes ranging from 1¼ to 3 inches, couplings have three parts—two corrosion-resistant malleable iron castings, and quick-locking wedge key and chain assembly to prevent loss of coupling parts. Gaskets have been designed to effect permanently tight seal on all types of pipe lines. They are available in synthetic rubber, neoprene, and natural rubber. Couplings are said to give up to 40-deg. flexibility at each joint, acting as sleeve, elbow, and ball union. Can be used for repairing any size leak that coupling will cover, and withstand normal working pressure of gas, steam, oil, and water. Drinkwater, Inc., 2323 South Michigan Ave., Chicago 16.

Acid Pump

Hand-operated suction pump built of an inert plastic is announced. Designed for safe handling of acid, it attaches to acid carboys of from 5 to 13 gallons inclusive. Pump is claimed to withstand constant immersion in practically all grades and kinds of commercial acids. Easily installed, it eliminates hazard of juggling heavy carboys. As the plastic is unaffected by alcohols, oils, or water, it also can be employed to transfer liquids such as bulk perfumes, essences, flavoring extracts, syrups, and liquid soaps from barrels or drums. Alden Speare's Sons Co., Cambridge, Mass.

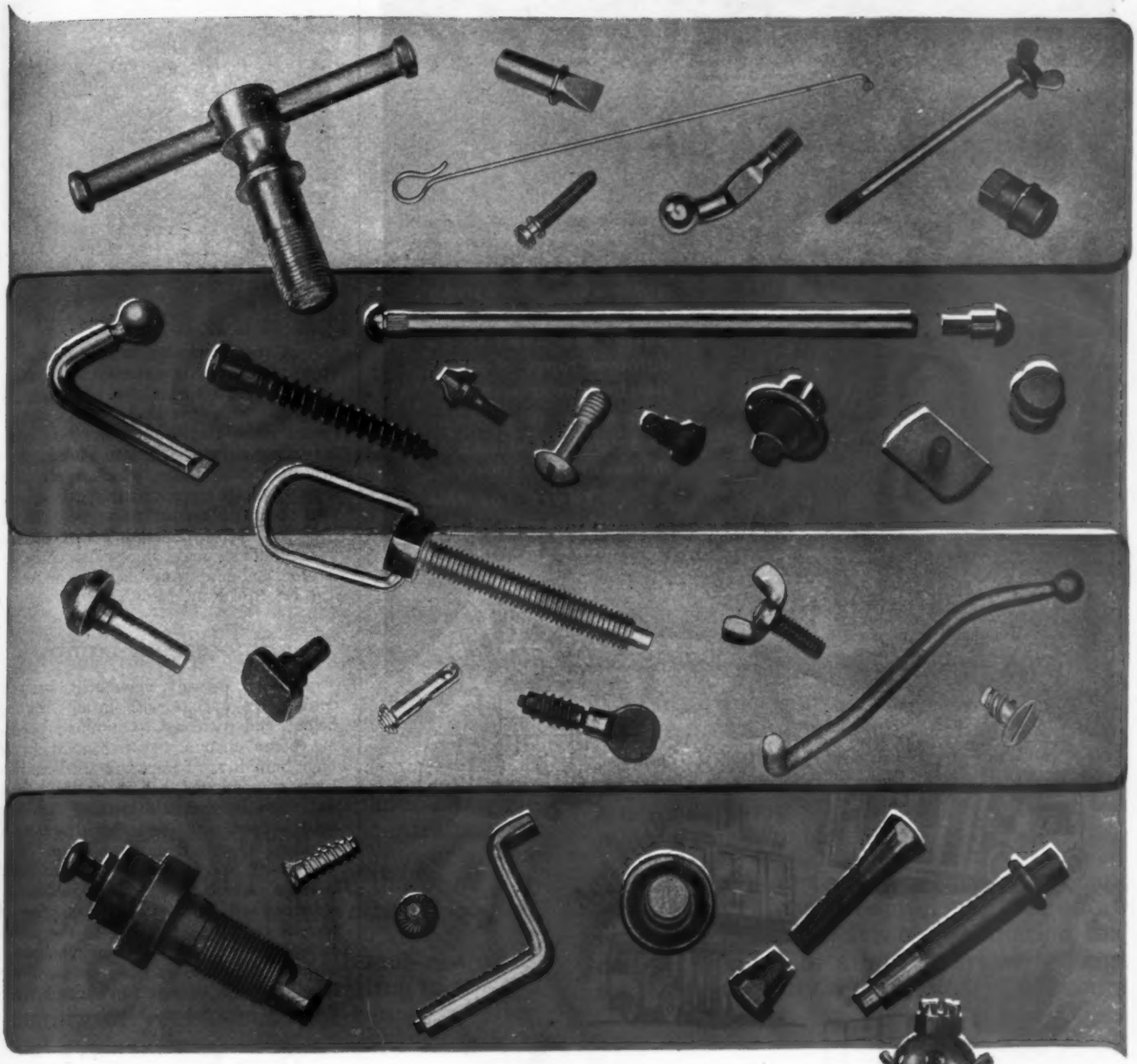


New Corporation

Refiners Lubricating Co., New York, announces formation of Safety & Maintenance Co., Inc., to handle its Speedi-Dri floor safety and maintenance products. Refiners Lubricating Co. will confine its activities to automotive lubricants.

Power Packs

Series of saturable reactor regulated power supplies has been developed for applications requiring d.c. voltages regulated to better than 5 percent from full load to no load, and having less than 1 percent ripple under full load conditions. Standard power packs range from 24-volt, ½-amp. to 500-volt, 200-m.a. units, and may be furnished with built-in automatic voltage regulators to compensate for line voltage changes. Units



Yes, we make "SPECIALS"!

Just take a good look at the picture above—a sample assortment of nonstandard products which we have made by the upset method. Most of these could not have been produced, in the time and quantity required, in any other way.

The upset or cold forging method also saves materials and lowers costs. And in many cases it makes a stronger, better product than that produced by other methods.

Maybe we can show YOU some important SAVINGS. Tough "specials" are right down our alley. Write us.

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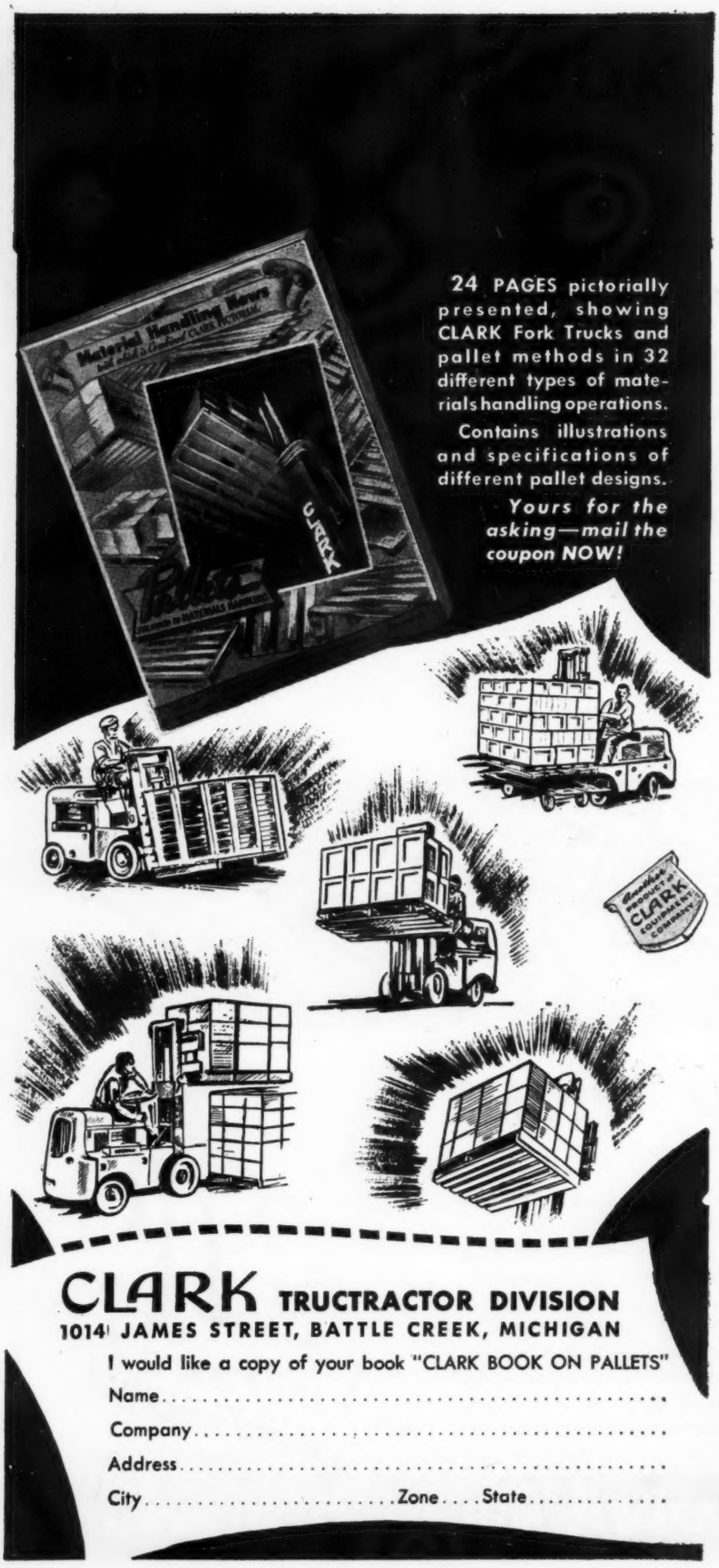
THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.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may be used as storage battery substitutes or to replace d.c. generators; a.c. voltage regulators are available also. All units are designed with overload safety factors. Power packs employing heavy-duty rectifier tubes are provided with built-in thermal time delay relays, which apply plate supply voltage approximately 30 seconds after rectifier filaments are heated. All are equipped with recessed male receptacles, female outlets, power line switch, pilot indicator, and fuse. Amplifier Co. of America, 398 Broadway, New York 13.

Fluorescent Lamp

Type T-12 40-watt fluorescent lamp is designed to operate with instant starting ballast, and is treated to eliminate operating faults encountered in conditions of high humidity. Lamps are used in two-lamp compensated ballast circuit providing 450-volt operation without affecting light output, life, or other features of standard 40-watt fluorescent lamps. Supplied with special invisible hydrophobic coatings which cannot be rubbed or scratched off, and prevent formation of film of moisture, according to the manufacturer. They are not interchangeable with standard 40-watt fluorescents, but have the same ratings. Sylvania Electric Products Inc., Salem, Mass.

Drum Handling Truck

Barrel-lift raises loaded drum off floor, transports, and tilts it to dispense contents. Drums may be rotated with little effort when mixing is desired prior to pouring. Pick-up is made with locked chain arrangement encircling drum. Self-locking stops provide fingertip safety control. Me

Are You Launching a New Product with

LIMITED CAPITAL?

You've got the product, you've got the sales plans, the men and a sizeable piece of capital.

But first you feel you've got to get a plant, and tools and machinery, and set up a production line.

And it all takes capital! And when you get around to merchandising your product through the trade and to the consumer, that money is going to be spread woefully thin.

"Divide and Conquer"

Why not divide the job into "manufacture" and "distribution", and concentrate your available capital and your manpower on one part at a time. BUT reverse the usual procedure and get going on the *distribution first.*

Get your product into the hands of dealers and to the public, without waiting to set up a factory of your own. That can come later, and in good time.

The important thing is to get there with the goods first. Get entrenched in distribution channels ahead of the other fellow in the mad scramble for that pent-up demand for consumer goods.

Let Lewyt be your factory

You can eliminate factory investment, inventory in materials and labor . . . and cut a sizeable chunk of time from your delivery schedule if you "Let Lewyt Do It".

You may find that we can actually save you money on the production. We are so accustomed to finding short cuts in tooling-up, economies in assembly methods, that getting a new job going in jig time and without lost motion comes natural.

Let us take over the production end . . and you concentrate your capital and your efforts on the distribution. It's a combination that can get you off to a head start in the consumer market on that new product of yours.

★ ★ ★

Write on your business stationery for 48-page book, "Let Lewyt Do It"—the story of the Lewyt organization in pictures. Lewyt Corporation, 82 Broadway, Brooklyn 11, N.Y.

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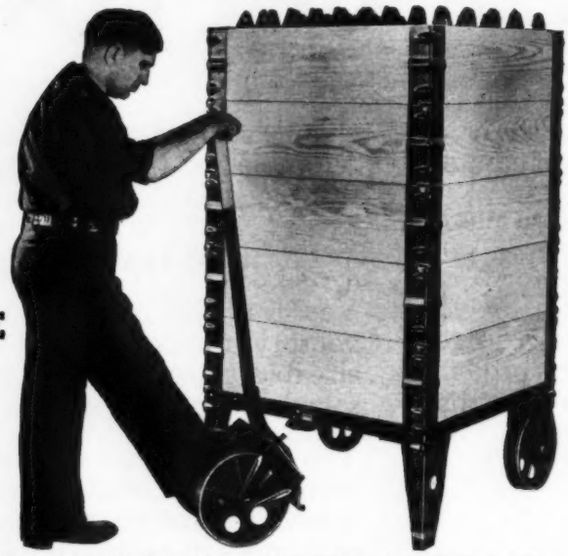
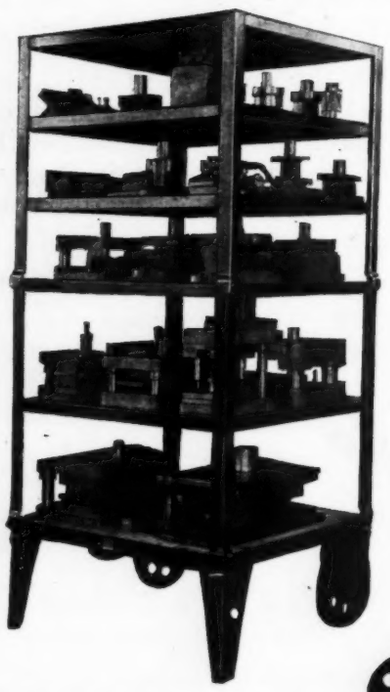
UNITS LIKE THESE Can DOUBLE Handling Efficiency In Your Plant!



Transport with Bin Sections easily moved with Turner Jimmy.



The TURNER SYSTEM is the most scientifically engineered procedure yet devised . . . to cut labor costs, save space and safely speed handling. Every Works Manager owes it to himself and to his company to know the TURNER SYSTEM.

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Industrial Engineers have long used the TURNER SYSTEM in their work to increase plant efficiency. You can get a complete outline of it in a twenty-page book sent to established companies. Write on your letterhead for your copy and information covering 60 day trial plan.

SIMPLIFIES YOUR DIE HANDLING PROBLEMS

Rugged Die Racks interlock on the Turner Transport and dies may be quickly moved to any part of the shop. Dies are always visible and easily accessible.

Illustration shows practical application of Box Rack. Standard Shop Boxes and Trays fit on its cross arms and slides, ready for instant removal.

FACTORY SERVICE COMPANY
4605 N. TWENTY-FIRST STREET MILWAUKEE 9, WISCONSIN

chanical linkage of lifter is adjustable to give several degrees of leverage, permitting handling of drums up to 1000 pounds. Saddle tilt locks hold open head drums in vertical position during transport, preventing tipping and spilling of contents. Drums also may be locked in tilted position. Use of lift enables drums to be handled by one operator. Unit is of heavy-duty all steel welded construction. Suitable for application where corrosive or flammable materials must be handled without spilling or slopping. Falstrom Co., Falstrom Court, Passaic, N. J.

Screw Driver Kit

Unbrako key kit resembles a screw driver in appearance, and has a hollow handle of transparent plastic forming receptacle for seven keys, or bits, comprising the kit. Keys that fit all socket head, Phillips head, or slotted screws are inserted in a

chuck in lower part of handle and used in vertical position. For use in ordinarily inaccessible locations they may be inserted in socket at right angles to handle. Kit is available in two sizes. Standard Pressed Steel Co., Jenkintown, Pa.

Balancing Ways

Line of super-sensitive balancing ways for static balancing operations is announced. Through use of scale type bearings in small 10-in. size, sensitivity to 0.007-oz. inches is said made possible, and sensitive bearings used in the 20- and 42-in. size permit accuracy in balancing to 0.009. Work is carried on free turning disks mounted on precision bearings. Disks are ground on outside diameters mounted on ground spindles and balanced. Standards supporting the revolving disks are movable on shafts to take different lengths of armatures within capacity of machine. Maximum strength and rigidity are obtained through use of solid end castings. The ways simplify static balancing, straightening, and truing operations of

This PRESSURE-TREATED wood structure got its test by fire . . . and PASSED with high honors

When this structure was built in 1942, the engineers specified Koppers Fire Retardant Treatment for the posts, girders, beams, joists and roof sheathing . . . and their foresight paid big dividends.

Recently a spark from a welding machine ignited waste lacquer in a pit below the floor. Flames shot up and mushroomed under the roof. A stream of water was directed to the roof but almost immediately diverted to the pit when it was observed the flames were not spreading along the treated timbers.

When the fire was extinguished, it was found that the metal lighting fixtures within a ceiling area of 20′ by 110′ were warped and ruined by the intense heat. The treated wood in the area directly above the fire was slightly charred but not sufficiently to require *any* replacements. Char on posts and girders was very light. Rafters in adjoining bays were slightly charred for half their length. *Normal manufacturing activities were resumed within three hours.* Experienced observers agreed that the fire retardant treatment had prevented serious damage to the building and interruption to important war production.

Fire retardance is only one of a number of important advantages of Koppers Pressure Treated Wood. It resists decay. It does not require periodical maintenance. It can be preframed to your blueprints, matchmarked and delivered ready for assembly by local labor. Ask for our booklet" Economical & Permanent Construction with Pressure Treated Wood."

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YEARS of experience in creating designing and manufacturing extruded and molded rubber parts for industry has taught us how, when and where rubber parts will best fill the bill. You may have a problem, a real "toughy", if so send it in, we may already have the answer. If not our engineers can create and design a rubber part that will whip the problem.
Our engineering skill, mass precision methods and production facilities are at your disposal. You'll find we are easy to do business with and anxious to serve.
THE JOHNSON RUBBER COMPANY
MIDDLEFIELD, OHIO

parts such as fans, pulleys, fly wheels, crank shafts, grinding wheels, and armatures, maker states. Four sizes are available—10-, 20-, 42-, and 60-in. swing, with 400-, 1000-, 1000-, and 5000-lb. capacity, respectively. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Metallizing Gun

Features incorporated in Mogul Model F metallizing gun are said to be economies in maintenance, production, and corrosion prevention spraying operations due to efficiency and high spraying speeds built into the unit. Gun is light in weight, balanced and smooth in operation; working parts are protected against dirt and foreign

matter by fine mesh screen over exhaust openings of gun when not in operation. Also, there are a minimum number of parts, and gun can be assembled or disassembled without use of special tools. Alignment of parts and distribution of weights are claimed to effect a wide speed range with no vibration on high operating speeds. Operation of the gun is not interrupted in changing spraying speed, and the device is capable of spraying up to 14 pounds of steel, 40 pounds of zinc, or 120 pounds of lead per hour, maker states. Metallizing Co. of America, 1330 West Congress St., Chicago 7.

Fuel Oil Concentrate

Corrosion and sticking of injector nozzles, as well as formation of hard carbon and sticking rings, are said to be prevented by addition of Gibraltar Diesel Fuel Oil Concentrate to diesel fuel oils. Gives overhead and cylinder lubrication, penetrating pores of the metal, and compounding non-combustible components of the

ATKINS
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ATKINS Silver Steel SAWS
CUTTING REPORT
Material: 4" x 3" Tungsten Tool Steel
Cutting Time with Previous Blade: 19 min. 40 sec.
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Increase in Cutting Speed: 214%
214%

Typical Performance with "*Silver Steel*" Blades

Reports like the above . . . typical of many now on record . . . are down-to-earth proof of the cutting superiority of Atkins "Silver Steel" Blades. The chances are good that these blades can improve metal cutting production in your shop . . . produce more cuts per shift and more cuts per blade . . . lower tool costs. We'll gladly arrange for an actual demonstration of Atkins "Silver Steel" Blades in your metal cutting department, on material you choose. Write us for details.

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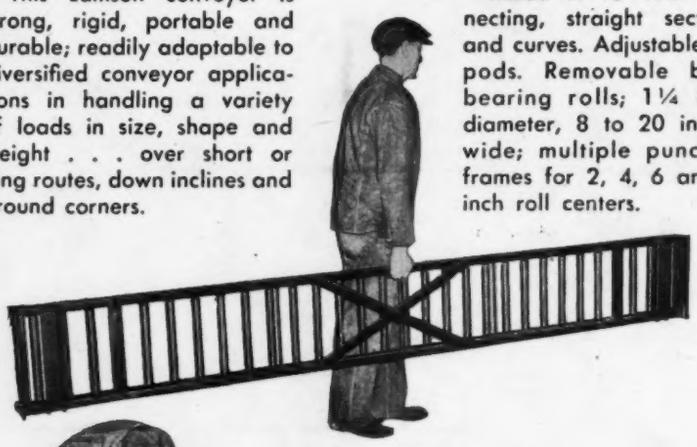
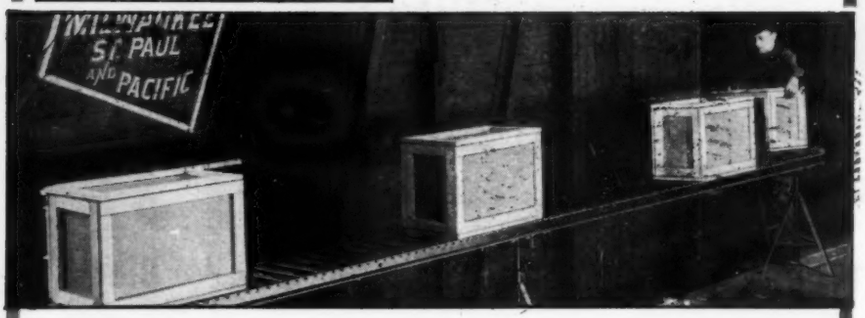
LAMSON Lightweight
PORTABLE GRAVITY CONVEYOR
Costs Less...Does More

This Lamson conveyor is strong, rigid, portable and durable; readily adaptable to diversified conveyor applications in handling a variety of loads in size, shape and weight . . . over short or long routes, down inclines and around corners.

Made in 10-foot connecting, straight sections and curves. Adjustable tripods. Removable ball-bearing rolls; 1¼ inch diameter, 8 to 20 inches wide; multiple punched frames for 2, 4, 6 and 8 inch roll centers.



Designed for fast, one-man set-up. Safely carries cleated boxes, fragile cartons, and those containing glass-packed products. Full length rolls facilitate the handling of top-heavy packages and restrain cartons from running off the sides. Live loads up to 46 pounds per foot are carried with a minimum of section deflection.



Saves time, cuts handling costs and reduces breakage in unloading and loading freight cars, trucks and trailers. This conveyor system can be extended to any section of a warehouse. It will profitably supplement any built-in conveyor system.

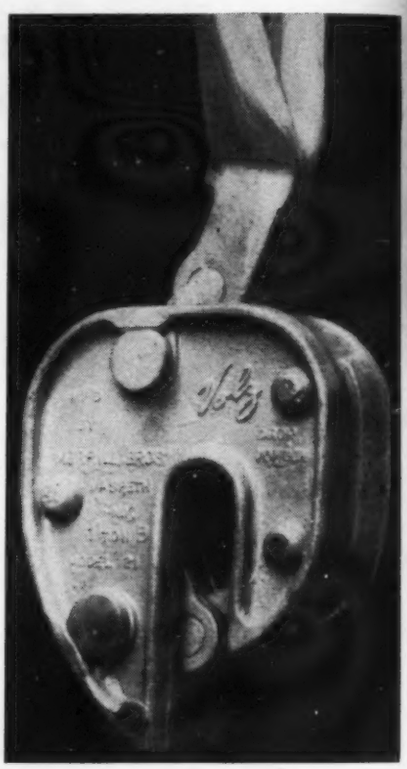
★ You will get the greatest measure of service from a Lamson Lightweight Portable Gravity Conveyor . . . and you will get a better value . . . a saving of up to 30% on the initial cost. WRITE TODAY for descriptive folder.

LAMSON CORPORATION
Makers of Conveyors and Pneumatic Dispatch Tubes
150 Lamson St., Syracuse 1, N. Y.

fuel oil, according to the maker. Manufactured from light mineral oil base, it is said to mix thoroughly without agitation with any regular type fuel oil. Hood Refining Co., 171 North Hamilton Ave., Greensburg, Pa.

Lifting Clamp

Lifting of light or heavy plates, barrels, or other containers, stampings or welded assemblies, or any metal with sufficiently flat surface for clamp to engage it, is facilitated by the Volz flat surface lifting clamp. Grip is effected in either a horizontal or a vertical position when load is applied in lifting or pulling applications. Releases automatically when load or weight is relieved from grip. Clamp has



two principles—one a pressure grip, the other a wedge grip—preventing the load from slipping, even if coated with grease or oil. All working parts are in a strong drop forged casing. Stationary jaw is actuated by cantilever basic principle. Clamp is made in four sizes—½-, 1-, 3-, and 6-ton capacities—and takes from 0 to 2 inches in thickness. Merrill Bros., 46-18 Arnold Ave., Maspeth, N. Y.

Prefabricated Metal Sheets

Prefabricated panel sheets in ½- or ¼-in. expanded metals are now available, for various assembly purposes. All parts are accurately die-formed to individual requirements and can be quickly assembled by workers without special training, according to the maker. Only standard tools are needed; no cutting or fitting is necessary on the job. Sheets can be removed quickly from outside to repair, and can be replaced without disturbing undamaged

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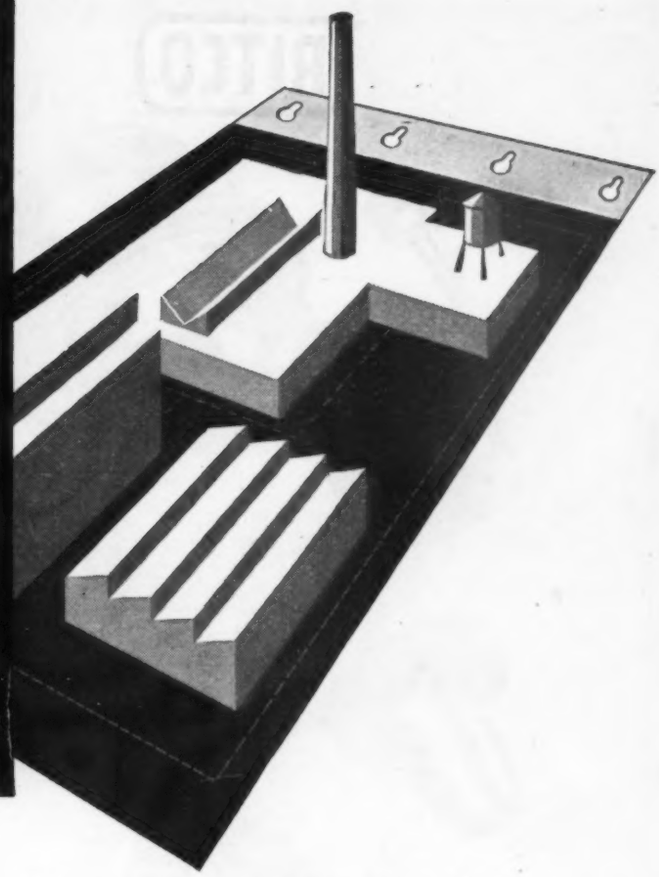

Here's a booklet that does two things for anyone faced with transfer of machinery and equipment to government warehouse storage. It describes the routine developed by the Defense Plant Corporation engineers and approved by the Reconstruction Finance Corporation. It tells you exactly how Mimeograph* equipment can produce the necessary paper work, quickly, efficiently, and easily.

In actual use, the Mimeograph stencil duplicating method has proved itself to be outstandingly suited to this application. It is flexible, registers accurately, reproduces at high speed in any wanted quantity. Black on white copies are always permanently legible.

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If you are looking for a sound and simple method of handling Contract Termination problems, our booklet, "The ABC of Contract Termination," will also be extremely helpful. It explains complete, practical methods for handling all the paper work involved . . . illustrates sample forms.

Mail the coupon below for either or both booklets. A. B. Dick Company, Chicago.

Mimeograph duplicator

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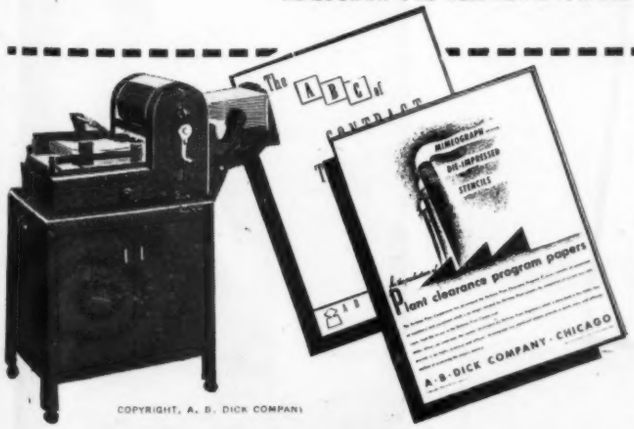

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sections. Structure provides simplified method of building guard rails, catwalks, open partitions, window guards, ventilator screens, and similar applications. Panel sheets also can be used in place of louvers or cutouts in the cabinets and enclosures. Lindsay & Lindsay, 222 West Adams St., Chicago.

Electrodes

Rexaloy overlay electrodes are for all ferrous metals and alloys. Operate with either a.c. or d.c. (straight or reverse polarity) machines, and coating is metallic, blending with core rod instead of forming slag, manufacturer states. The electrodes are said to be unaffected by moisture to the extent that they will perform as formerly, after drying. Deposits can be forged and heat-treated, and have Brinnell hardness rating of 300 to 687, depending on the base metal on which they are deposited. The electrodes, as overlay or inlay on machinery part, are claimed to prolong life and increase efficiency of part involved, replacing worn-away metal of used parts, as well as to minimize loss of metal from surface of new part by application of thin layer of a hard alloy. The Sight Feed Generator Co., Richmond, Ind.

Dust Collector

Portable dust collector, for grinders, sanders, abrasive disks, cut-offs, and polishing lathes, is presented. Of the recirculating type, Model 420 features a cyclone separator, motor driven multiple blade fan, large dust storage bin, and flat spun glass filter, contained in single all-steel, fire-safe unit. Measuring 12 x 22 x 24 inches, it

NEW LO-HED CAR PULLER

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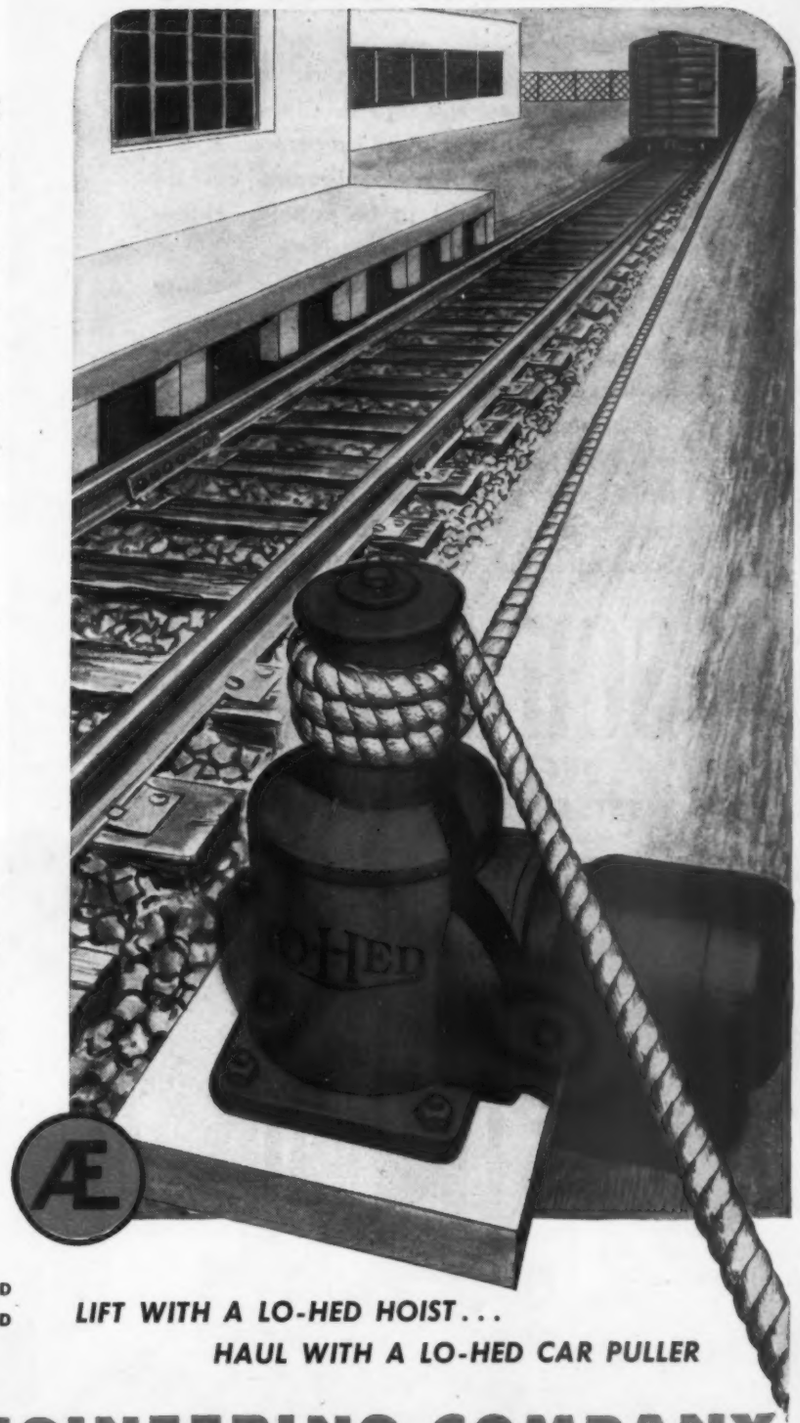
WHY take the chance of injuring men, why wait for shifting engines? Now you can shift railroad cars about at will with one or more Lo-Hed Car Pullers on your siding. Just hitch a line to the car, loop the other end around the puller barrel, press a button and the car is on its way to the desired location.

The Lo-Hed Car Puller eliminates a dangerous, back-breaking operation. It speeds loading and unloading, reduces demurrage and ends shifting charges.

Built by the makers of the famous Lo-Hed Electric Hoists, the Lo-Hed Car Puller is a sturdy, electric hauling device. It has many profitable uses in and about the plant, too. Write now for folder giving full details.



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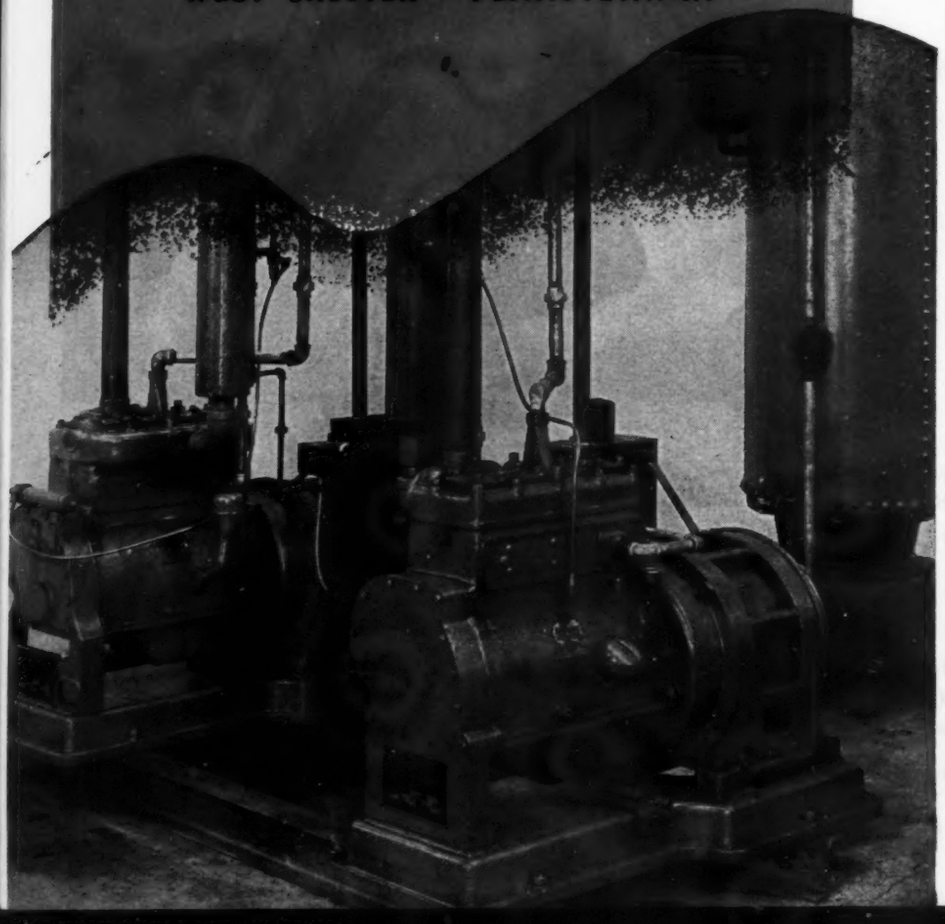
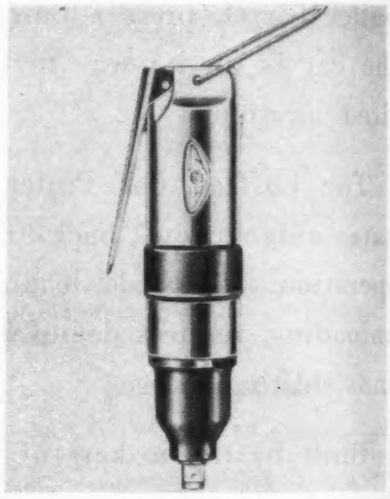


takes little space, either behind grinder or beside it. Installation requires no tools, and is accomplished by slipping flexible metal hose onto inlet sleeves of dust collector and connecting hose to dust outlet of grinder. Dust storage compartment is the size of entire base of the machine. Plate on the front of device is removed to empty collected dust. Power to provide suction is supplied by multiple blade fan driven by ¼-h.p., 3450 r.p.m. motor. Aget-Detroit Co., 602 First National Bldg., Ann Arbor, Mich.

Impact Wrench

A ¼-in. capacity pneumatic impact wrench has straight-type grid and lever control. Said to deliver ample power for dependable, stall-proof operation, it is suited to assembly-line jobs of nut-setting and screw-driving. Through its torque control mechanism, stretching or burning of threads is eliminated. It has calibrated adjusting screw on side of motor that enables operator to set bolt or nut to any desired tension. Control is obtained primarily through construc-

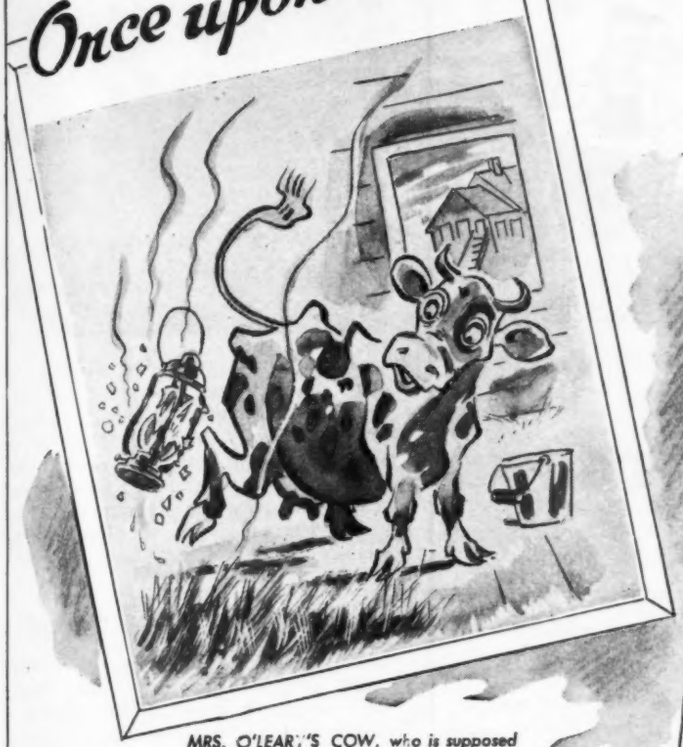


tion of roller clutch impacting mechanism, which consists of four major parts —anvil, hammer, and two cylindrical steel rollers. Motor proper is governor controlled, employing a 6-bladed rotor mounted on precision ball bearings, and is housed in an aluminum case. The complete tool has been designed for perfect balance and easy handling, maker says. Model 3012 has ⅜-in. sq. drive with capacity for ¼-inch bolts and nuts. Available with button control or in pistol grip type. Aro Equipment Corp., Bryan, Ohio.

Lift Slings

Made in 4-, 7-, 14-, 25-, and 40-ton capacities, automatically equalizing chain slings, called Safe-T-Lift, are presented. The 7-ton chain sling is stated to have a safety factor of 4¼ times the design load. Equalizing unit consists of a steel block and floating sheave constructed to fit the steel alloy chain. When loads are lifted, one chain leg becomes longer than the other, and as weight of load pulls on chain, sheave in equalizing unit pulls down

Once upon a time...



MRS. O'LEARY'S COW, who is supposed to have started the great Chicago fire

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The story of Mrs. O'Leary's cow has never been exactly proved, but it does serve to point out that big fires can have a very little beginning.* The Badger Fire Extinguisher Company manufactures the most modern and reliable fire extinguishers for industrial plants and institutions of every type. Right now, we are ready to tackle your fire problems before they happen, and we offer a complete range of F. M. and Underwriters' approved equipment, effective against most inflammable liquid, electrical, and other types of fires.

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A JOB IS A RESPONSIBILITY TOO

We hear a lot about the responsibility of industry to provide jobs for all who want to work. Industry wants to accept that responsibility. For the only way industry can prosper is by putting people to work—creative work that produces things that can be sold.

But what about the responsibility of the worker?

Industry prospers by selling what it produces to people who want to buy—by giving the buyer a value that is worth more to him than the money he pays out.

Doesn't the worker have a responsibility to do just that with the time, energy and skill he sells to industry when he takes a job?

There is only one realistic answer to the worker's question. "How can I get more pay?" That answer is to *earn* more by *producing* more.

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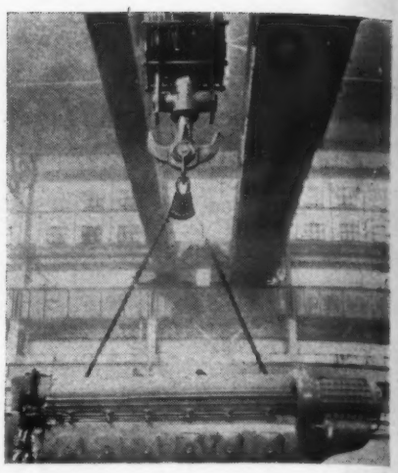

against a brake, preventing slippage. If crane operator does not get crane hook and equalizing unit close enough to load's center of gravity, load is lowered to relieve tension on sling and release brake. Crane hook is then moved over to true center of gravity and when power is applied chain readjusts for level lifting. Hercules Sling Co., Rockford, Ill.

Lubricating Compound

Chemicals and oils make up 5-way lubricating compound now introduced. Maker states that it performs with high degree of efficiency; acts as penetrant, rust inhibitor, polish, cutting oil, and light, medium, or heavy lubricant, all in one. Treats washers, mixers, fans; protects and prevents rust on tools; prevents stripping and breaking; dissolves gummy oils and grease; lubricates tools and machinery and provides protection against salt or other water. Slipit Products, Inc., 169 Water St., New York.

Pipe Scraping Tool

Power-driven tool for cutting, scraping, or polishing the inside of straight, curved, or fitted pipe and tubing is designed to house and drive ½ inch x 100 feet of flexible steel shafting. Flexible cable automatically coils and uncoils as it is fed into and from container. Driving mechanism is a removable motor driven head. For removing waste material or scale the flexible rod is equipped with elliptical shaped, spring steel cutter heads with speed of 300 r.p.m. Shafting causes cutter head to follow

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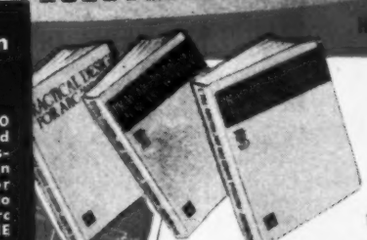

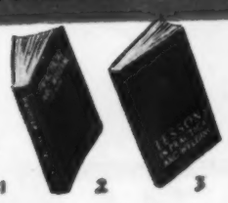

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USE HARPER NON-FERROUS AND STAINLESS FASTENINGS

Rust is the Great Destroyer. Every year it causes damage of "war debt" proportions.

Fortunately, the cost of preventing rust and corrosion through the use of Harper Everlasting Fastenings is low. Of course, the first cost of a bronze bolt or a stainless screw is more than a comparable fastening made of common steel. Yet the difference in price is small, particularly when considered in relation to the total cost of a machine, instrument or other fastened assembly. Everlasting fastenings add longer service life to your product... and the ability to perform under tough conditions. Such qualities provide a big advantage over competition.

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Harper is known as "Headquarters for Non-Ferrous and Stainless Fastenings"... carries large and complete stocks of 4360 different items and is continually adding others... maintains large stocks of metals in bars, rods, wire, sheet and other basic forms from which special fastenings can be quickly made. Write for 1945 Catalog.

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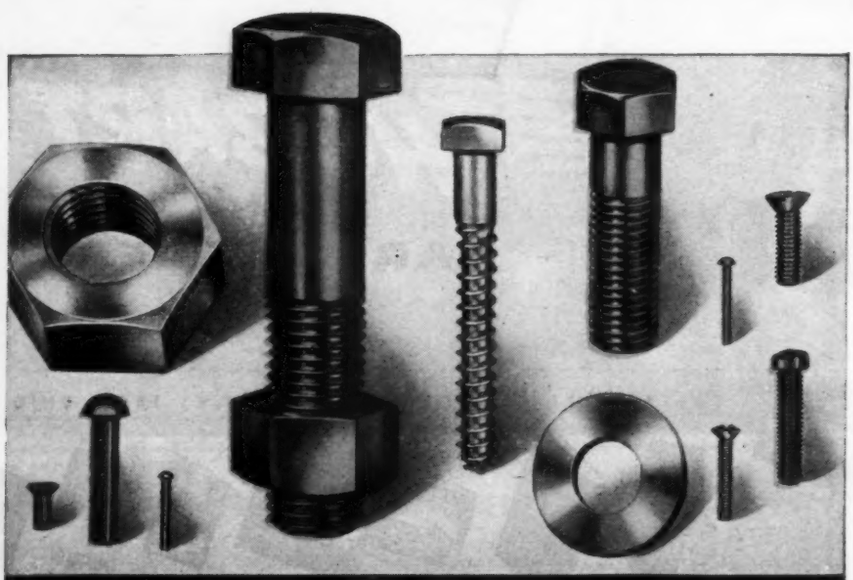

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EVERLASTING FASTENINGS
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through bent tubing or pipe containing series of fittings. Upon encountering resistance from obstruction within cylindrical opening, rod stores up energy until accumulation of torque overcomes resistance, and release of such torque load spins cutter at speed approximating 750 r.p.m. Device is used for maintaining open drain pipe, cleaning water-tube boilers, flues, steam risers, and other process plant piping. The Spartan Tool Co., 6007 Lincoln Ave., Chicago.

Hospital Stool

All steel welded adjustable stool, Model D-1017, is for hospital and first aid rooms. It is aluminum finished, resistant to antiseptics, chipping, and darkening, except for seat, which is polished stainless steel,

13 inches wide, and may be adjusted to height of 32 inches or lowered to 18 inches. Rubber tips on leg bottoms and rubber covered heel bar prevent wear and noise. Long center steel post gives stability. ASCO Mfg. Co., 601 South Anderson St., Los Angeles 23.

Non-Corrosive Flux

Zenith Super Flux is now available to industry for soldering electric connections. Claimed to be non-corrosive, it can be utilized on copper, cadmium plated brass and steel, black steel, and to facilitate tinning of soldering tips. Applied by brush or dipping, and adheres to the work. Polan Industries, Huntington 19, W. Va.

Interchangeable Drill

Known as Drilpilot, tool permits drilling and countersinking, drilling and spotfacing, or drilling and counterboring in one operation. Of rigid simple construction, it is made of high speed steel ground for close tolerances after hardening. Body of drill is $\frac{3}{8}$ inch long with a $\frac{7}{16}$-in. flute length, and $\frac{1}{16}$ inch of solid drill body which acts as pilot after hole is drilled. Shank is .086 diameter and $\frac{3}{8}$ inch long. Comes in standard rivet sizes Nos. 40, 30, 21, and 10. Device can be changed over from one job to the next and put through range of operations. Combined with manufacturer's standard or microset stop countersink it permits drilling and countersinking in one operation to predetermined diameter. Used with standard angle drill

PUT YOUR STOCKPILES ON WHEELS

with this new rubber-tired tool to cut industrial cost

HERE'S a brand new industrial tool—a crane designed from scratch for the material handling jobs of modern industry. One man operating this rubber-tired, self-propelled crane can make your stock supply service as effective as though every stockpile were on wheels.

The single operator moves the crane and operates it from the same seat and with the same engine. Its 12 rubber tires give it "soft ground flotation" and tractive effort to get into and out of every corner of your yard. Scattered yards are no problem—as they are with fixed track equipment—because this Lorain self-propelled crane can shuttle between them with rubber-tired mobility.

14 MACHINES IN ONE

Around the average plant there need never be an idle moment for the Lorain crane. Here are 14 ways you can handle most any material with this versatile machine: Clamshell Buckets, Dragline Buckets, Orange Peel Buckets, Skips, Grabs, Concrete Buckets, Slings, Grapples, Skull Cracker, Hook Blocks, Tongs, Special Hooks, LCL Containers, Magnet.

CHECK THESE FEATURES

Single Engine for crane operation and travel. One-Man Operation. 4 Travel Speeds—forward or reverse. 20 Ton Capacity. Special 6-Wheel Carrier with 12 rubber tires. Travels anywhere. Needs no tracks or special roadways. Air Power Steering.

Ask your Lorain distributor about the complete line—rubber-tired self-propelled cranes, rubber-tired Moto-Cranes, large crawler-mounted and small crawler-mounted cranes. There's a size and type to fit your job.

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GET YOUR COPY OF THE NEW ROSS BOOK, "HIGH SPEED HANDLING." Ask for Bulletin F-95

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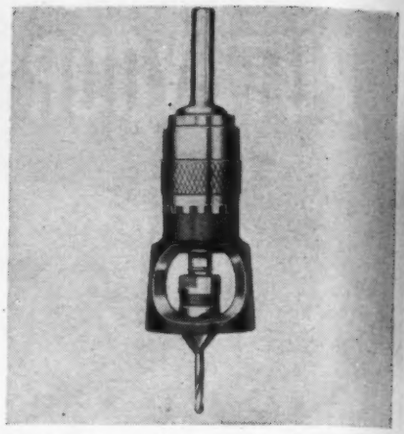


adapters or attachments, drilling and countersinking, or drilling and spotfacing can be performed in difficult-to-reach spots. Aircraft Tools, Inc., 750 East Gage Ave., Los Angeles 1, Calif.

Circulators

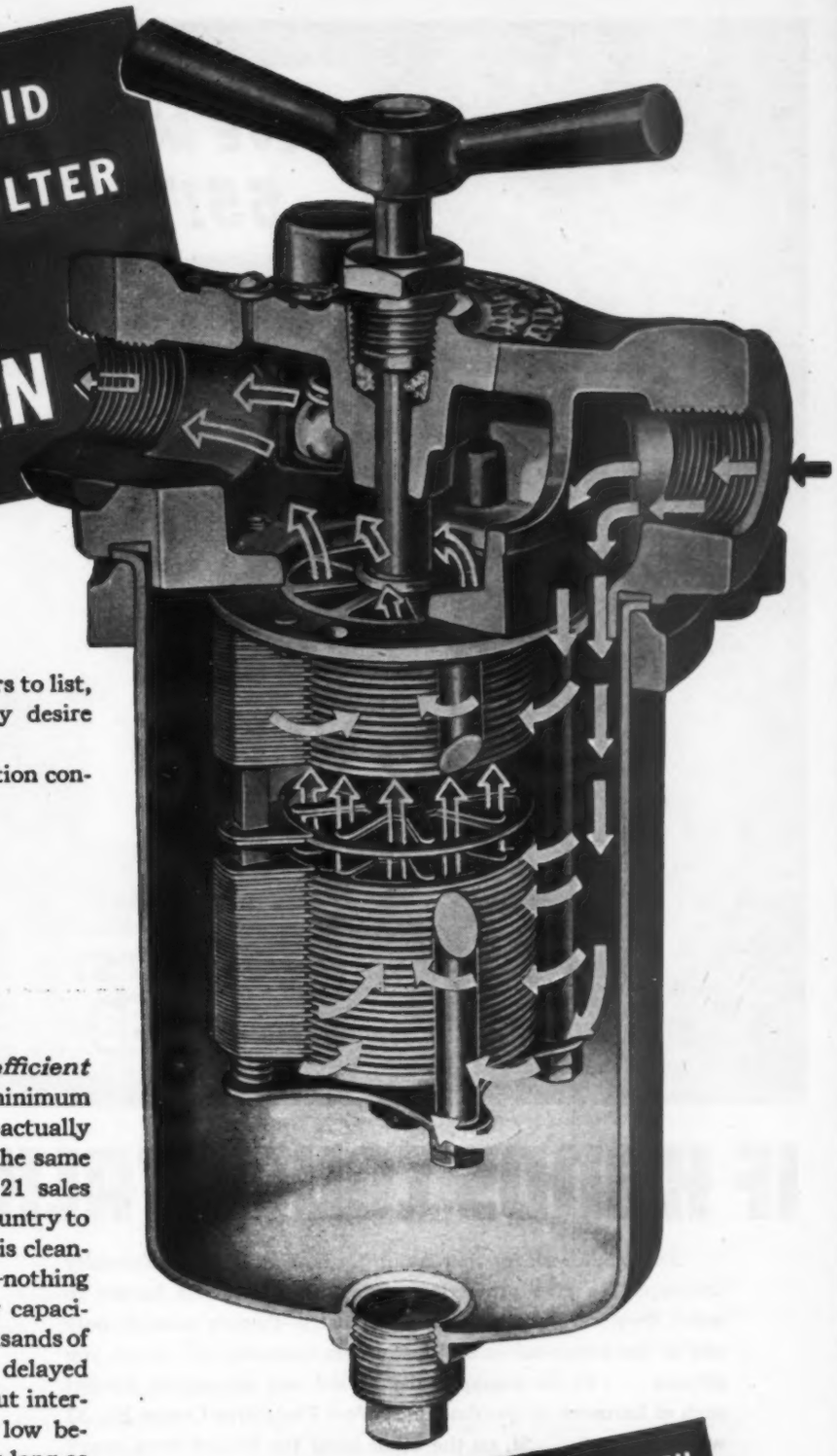
Axiaflo circulators handle a large volume of liquid at low heads, with minimum power requirements. Units are equipped with full ball bearing totally enclosed dynamically balanced motors. Sizes avail-

able are 4-inch, with ¼-hp. motor, and 6-inch, with ½-hp. motor. The discharge capacities are 280, 700, 950, and 1200 g.p.m. Ruthman Machinery Co., 1810 Reading Rd., Cincinnati 2.

Recessed Fluorescent Fixture

Lighting unit, called Recessed Troffer, is designed to fit in as little as a 7-in. space between the true and the false ceiling into which fixtures are placed. Equipped with E-Z Servicer, glass shield or louver may be opened or removed for maintenance by raising one side, sliding shield over, and dropping low side. No tools are needed to clean or change tubes, and top of reflector also is removed easily so that

WHAT YOU'VE SAID YOU WANT IN A FILTER YOU GET IN AN AUTO-KLEAN



WE asked a large number of manufacturers to list, in order of importance, the features they desire most in a fluid-cleaning device.

Here's what the men in charge of production considered most important:

1. Efficiency
2. Simplicity and compactness
3. Service from supplier
4. Ease of maintenance
5. Capacity
6. Continuous operation
7. Maintenance cost

Now consider the Cuno Auto-Klean. (1) It's *efficient*—positively stops all solids larger than minimum size specified. (2) It's simple and *compact*—actually smaller in size than other filters handling the same volume at equal porosity. (3) There are 21 sales engineering organizations throughout the country to provide service. (4) It's easy to maintain—is cleanable just by turning a handle, or by motor—nothing to replace or remove for cleaning. (5) Flow capacities range from a fraction of a gallon to thousands of gallons per minute. (6) Production is never delayed—the filter is continuously cleanable without interfering with flow. (7) Maintenance cost is low because the all-metal filter element will last as long as the equipment on which it is installed.

Cuno Auto-Klean—an all-metal, non-collapsible filter—is being used successfully on a variety of applications . . . from high-pressure to gravity-feed systems . . . from straining river water to filtering heaviest fuel oil.

You'll find filter selection information and specifications on the Cuno Auto-Klean in SWEET'S—or write us for Mechanical and Process Industries Catalog, Cuno Engineering Corporation, 609 South Vine Street, Meriden, Connecticut.

KEEP FLOW ON "GO" WITH

CUNO

THE "FILTER-FINE" STRAINER

IF HANDS COULD TALK

. . . they would ask for that cream formula which was especially developed to give protection against the particular hazard to which they were exposed in your industry. Two, or possibly only one of the entire series of West cream formulas will be all you require . . . If, for example, the hazard was an organic solvent such as kerosene or gasoline, etc., West Protective Cream No. 33 would be best . . . If, on the other hand the hazard were heavy oils and greases, West Protective Cream No. 22 would give more adequate protection . . . The booklet "Production Safeguards Against Dermatitis" tabulates most proven skin irritants and the West creams best suited for combatting each specific hazard.

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wiring and ballasts may be reached without taking down the fixture. Made for both individual installation or continuous runs in open, louvered, or ribbed glass models for two, three, or four 40-watt lamps with instant start or starter ballasts. Construction is of welded steel with inside reflector and louvers finished in 85 percent reflection polymerized white, infrared baked at 300 degrees. Unit fits into ceiling opening of 12 x 48 inches. R. & W. Wiley, Inc., 129 Dearborn St., Buffalo 7.

Electric Marker

Small in size—6 inches long, and weighing 10 ounces—electric marker can be used continuously on the toughest of marking jobs, manufacturer claims. Has increased power of cutting stroke, and adjusting nut makes it possible to vary impact for marking glass. Shaped to fit the hand, it can be

held and used to write almost as easily as a pencil. Operates from any a.c. electric outlet. Applied like a small electric hammer, it makes 7200 cutting strokes per minute into the surface, leaving lines that cannot be wiped away or worn off with ordinary usage. Marks sizes, names, numbers, and similar information on tools, parts, and other products of iron, steel, bronze, aluminum, ceramics, tile, marble, lead, plastics, porcelain, and glass. For average marking a hardened alloy point is furnished as standard. Diamond point is recommended for extra hard materials. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Rust Resistant Coating

Steel and galvanized wire are claimed to be protected against rust by a coating called No. 66. The compound keeps wire and sheet metal bright as new. Nox-Rust Corp., 2459 S. Halsted St., Chicago 8.

Lightning Arrester

Pellet-type lightning arresters, for protection of apparatus on distribution circuits 15,000 volts and below, now have a separately sealed nitrogen-filled gap chamber. The dry-nitrogen prevents formation of ozone or oxides, keeps gap electrodes bright, and gives stable gap-sparkover characteristics. To eliminate effects of internal condensation caused by changes in outdoor temperature, all air and atmospheric

As seen and heard in a New England laboratory by David Dietz, Science Editor of Scripps-Howard

"In two minutes, a blast like the crash of a field gun will shake this quiet laboratory. The research scientist you see here is carrying out a test that will save lives—one of the 37 ruthless steps by which modern engineering makes Plymouth Rope *prove* its strength for vital jobs.

"The Riehle tensile-strength testing machine you observe is the only one of its great size in the world. It is powerful enough to snap a big rope in two with a pulling force up to 120,000 pounds.

"I watched this exciting test, minute by minute, as the dial indicator crept up, ton after ton, until the fibers of this 7½ inch circumference war-time sisal rope on the testing machine crackled and snapped at 43,430 pounds—over 21 *tons!*

"Plymouth Ropes of every type are subjected to these breaking tests. A Nylon rope of 9 inch circumference, for instance, withstood a pull of 116,000 pounds—about the combined weight of *55 popular-type motor cars!*

"This is one of the final steps taken at Plymouth—largest rope-maker in the world—to build ropes of greater strength, longer life, more useful performance. Precision methods of manufacture and carefully selected materials are tested at each stage, from the choice of raw fibers to the packing of finished coils of Plymouth Rope—for dependable use in peace or war—at sea, on farms and ranches, in factories and in your own home."

Plymouth Cordage Company, Plymouth, Massachusetts. District Offices: New York, Chicago, Houston, San Francisco. Warehouse Stocks: New York, Boston, Philadelphia, Baltimore, Houston, Chicago, San Francisco.

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PLYMOUTH

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THE ROPE YOU CAN TRUST

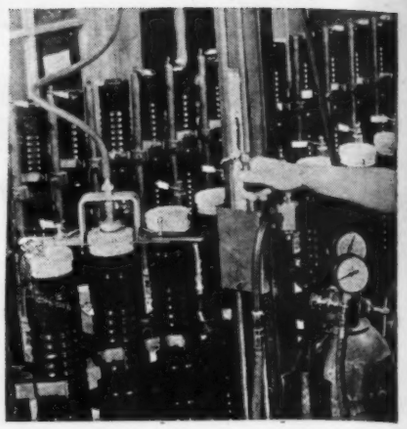
Logan ROLLER CONVEYOR STORAGE LINES SPEED SHIPPING OPERATIONS

7 GRAVITY STORAGE LINES eliminate handling and shelving space by permitting the flow of finished electrical equipment direct from shop area to the shipping department. A belt conveyor from the floor above equipped with automatic deflectors feeds these storage lines. Assortments for shipping are made from these lines, placed on the belt conveyor which can be seen in the foreground and are carried to the packing room.

Logan engineers are thoroughly experienced in Storage Conveyor engineering for both manufacturing and shipping operations. Catalog 35 A contains many examples of such installations — send for a copy. There's no obligation.

Logan Co., Inc., 510 Cabel St., Louisville 6, Kentucky

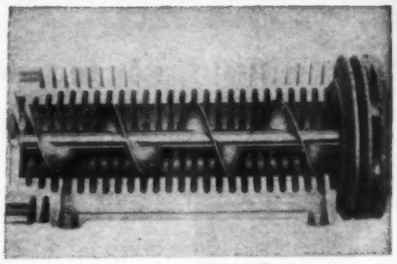
Put *flow* INTO SHIPPING with *Logan* EQUIPMENT



moisture is completely evacuated from gap chamber. This process provides error-proof vacuum-withstand test of the main sealing of each arrester, maker states. After evacuating gap chamber, dry-nitrogen is injected through small treating hole in the metal cap which is then immediately permanently solder-sealed. General Electric Co., Transformer Div., Pittsfield, Mass.

Temperature Exchanger

Based on the principle of heat transfer for air and gas lines, temperature exchanger can be used for external heating applications and purification by centrifugal action. Unit, as an after-cooler, is installed at the compressor discharge point. Supplied with external and internal cooling fins, the temperature exchanger features multiple action



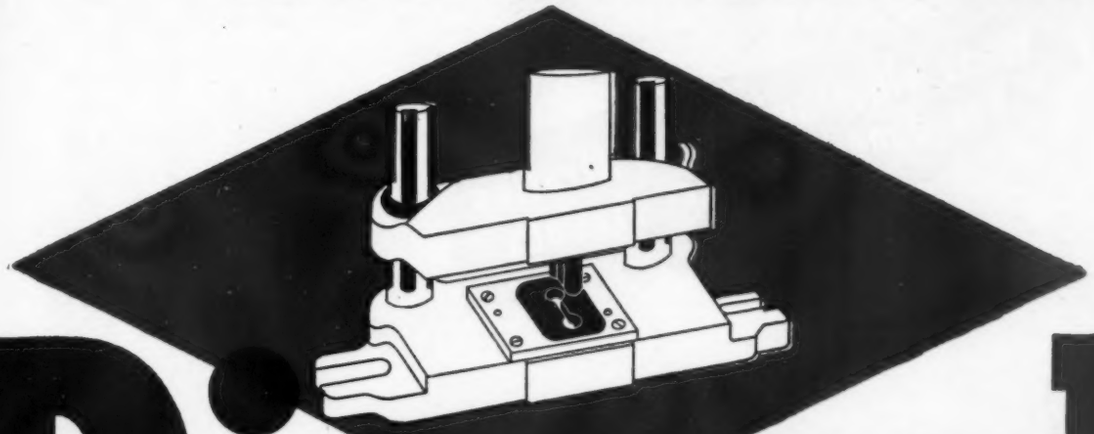
helicoid flighting. For large volumes of air or gas, parallel assemblies may be made. Tandem installation is permitted to any required length. Controls are available for both flanged and screwed-type assemblies, and also may be provided for either manual or automatic draining of sump. The Bird-White Co., 3119 West Lake St., Chicago 12.

Flame-Resistant Compound

Chlorinated paraffin, called Clorafin 42 and 70, now taken off allocation, is claimed to flame- and weather-proof fabrics, paints, and linoleum. Material treated with the compounds are said to be color fast, flexible, stable in water, resistant to high and low temperatures, and free of objectionable odors. Clorafin 42 is a viscous, nonflammable liquid plasticizer soluble in a range of solvents. It is compatible with chemical and oil plasticizers, waxes, resins, and is used as plasticizer for vinyl copolymers. Can be used in inks, high pressure lubricants, cutting oils, carbon removal compounds, and metal drawing compounds. Clorafin 70 is nonflam-

HERE IT IS *Firth-Sterling's*

original development of sintered carbide for BLANKING and FORMING dies



Diecarb

DIECARB, perfected over several years of research, trials and practical tests, is now offered to the trade for blanking die applications—a "natural" for extremely high production work, and providing extraordinarily long life between grinds.

DIECARB grades are available for blanking up to 7/16" in thickness for a variety of materials including metals, plastics, paper, etc. Performance runs have produced 10 to 1000 times the number of pieces per grind compared with former dies . . . downtime of six to eight weeks per year has been saved . . . operating costs have been lowered substantially.

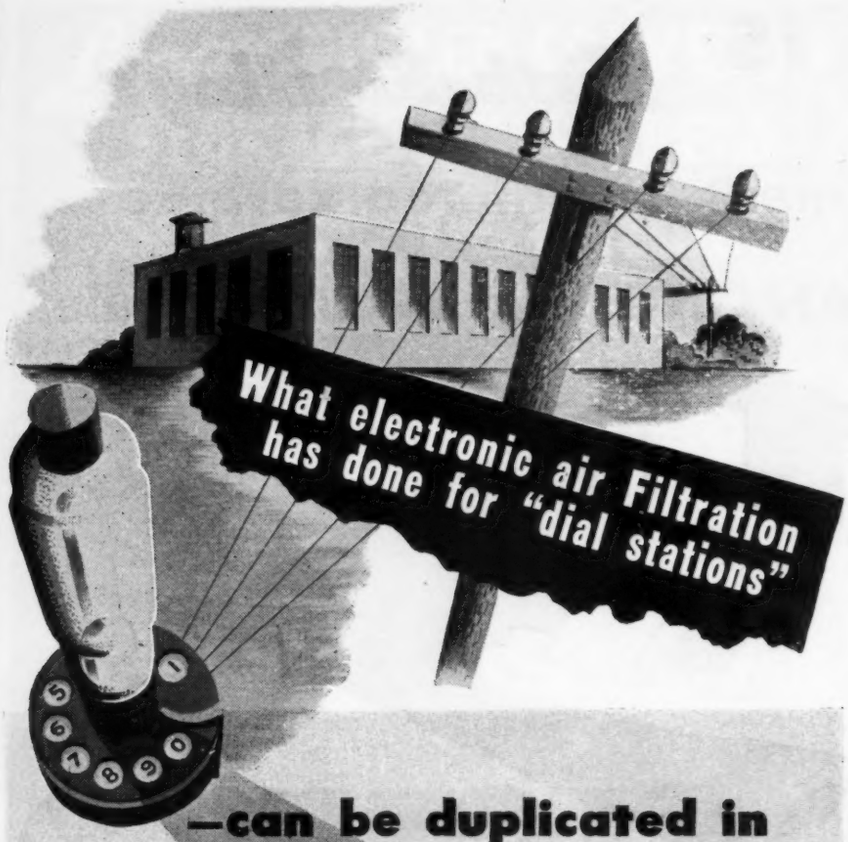
If you have a blanking application now, or are planning postwar products where blanking and forming are important operations—investigate the possibilities of Diecarb.

GET IN TOUCH WITH US *Complete Diecarb Engineering Services are ready for you—die designers, brazing engineers, practical grinding men—to help you and to teach your operating personnel the fine points and short cuts of Diecarb die-making and operating.*

Diecarb

Firth-Sterling
STEEL COMPANY

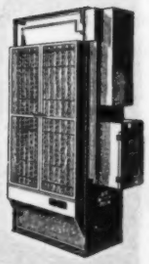
OFFICES: McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA • PITTSBURGH • CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES



—can be duplicated in many industrial plants

PROVIDING SUPER CLEAN AIR for dial stations where automatic telephone switch board equipment operates, is a job made to order for AAF Electronic Air Filters—and they are performing this exacting service, with complete satisfaction, in cities throughout the country. The same clean air requirements are present in many industries today where materials in process must be protected against spoilage by dust, soot or smoke and where worker efficiency is impaired by air contamination. AAF has developed the first complete line of Electronic Air Filters, making super clean air available for every industrial and commercial need. Write for copy of booklet "The Magic of Electronics in Air Filtration" just off the press.

AMERICAN AIR FILTER COMPANY, INC.
Incorporated
361 Central Avenue, Louisville 8, Ky.
In Canada, Darling Bros., Ltd., Montreal, P. Q.

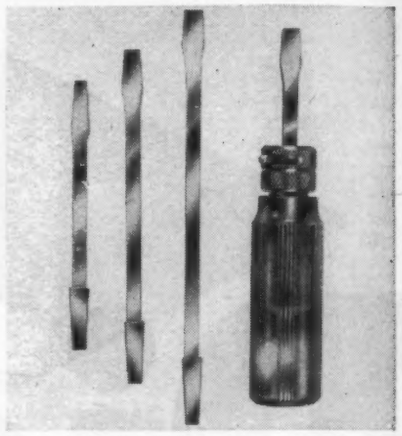


AAF *Electro-matic*
THE ELECTRONIC AIR FILTER

mable solid resin with comparatively high melting point, and is compatible with plasticizers, waxes, and other resins. Suitable in flame-retardant paints and to formulate adhesives. Hercules Powder Co. Inc., Wilmington, Del.

Screw Driver Set

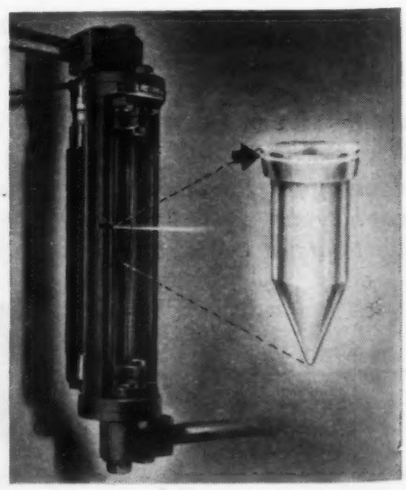
Day tool driver and blades offer a simple means of having size range of screw drivers quickly available to fit job at hand. Tool made in two sizes, occupies little space. The smaller consists of driver with four blades ranging from 1½ to 5½ inches in



length, and the larger includes four blades from 8 to 14 inches in length. Handle is made of durable plastic with simplified alloy steel device that locks blade securely, yet allows for its instant release by a flick of thumb. Blades are drop-forged from alloy steel. Speedway Engineering Co., 2479 Fletcher Dr., Los Angeles 26.

Rotameter Rotor

For sharp, clear rotameter readings of opaque liquids, patented Line-O-Light rotor features disk of light-transmitting material sandwiched in rotor head which reduces distance light must travel through the opaque liquid from its source behind tube. Rate-of-flow is thereby delineated sharply in resultant band of light on tube reference scale, and operators can make easy, accurate readings. Rotor can be used for many applications and in any type tapered glass tube rotameter. Two types of



PROTECT your workers with these 2 hand creams

—made by Du Pont

You can now supply your workers with two types of PRO-TEK—and meet almost every requirement for a hand protective cream.

The standard PRO-TEK is not affected by grime, paints, solvents and insoluble oils, but washes off quickly with soap and water. PRO-TEK No. 2 resists water-mixed cutting oils, milk acids, alkalies and other aqueous solutions.

Both types of PRO-TEK are applied before starting work. They are safe, sanitary and easy to use. Both are extensively used in many large factories, and are recommended by safety engineers and plant hygienists.

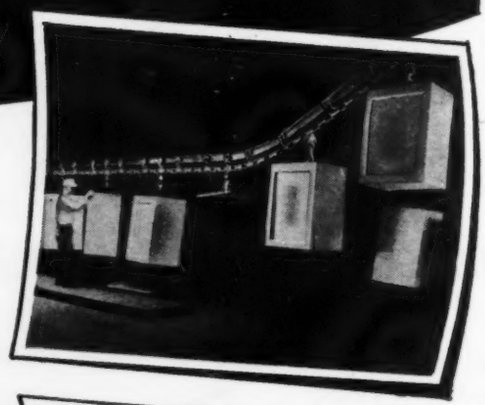
If you're not already using these outstanding hand protective creams, ask your jobber about them—or write direct for free samples to E. I. du Pont de Nemours & Co. (Inc.), Dept. FM-5, Wilmington 98. Delaware.

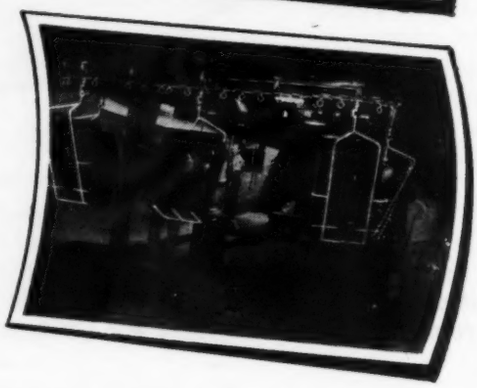
DU PONT PRO-TEK

REG. U. S. PAT. OFF.

HAND PROTECTIVE CREAM

★Alvey-Ferguson conveyors will help this manufacturer produce *More Post-War Refrigerators PER HOUR!*





YOU know that in the post-war era you must make *your* post-war products more economically.

YOU know that efficient, conveyorized mass production lowers production costs.

Isn't it wise, then, to discuss your materials handling and products handling problems *now* with an A-F "Indoor Transportation" Engineer, backed by 43 years of "know-how", before final plans are made to reconvert *your* plant to post-war output? Without obligation on your part, write for literature or a discussion of your problem.

ARMY E NAVY

THE ALVEY-FERGUSON CO.

Offices in Principal Cities 138 Disney St., Cincinnati 9, Ohio

Affiliated Corporation

The Alvey-Ferguson Company of California

P. O. Box 396, Vernon Branch, Los Angeles 11, Cal.

CONVEYING EQUIPMENT

CONVEYING MACHINERY A-F

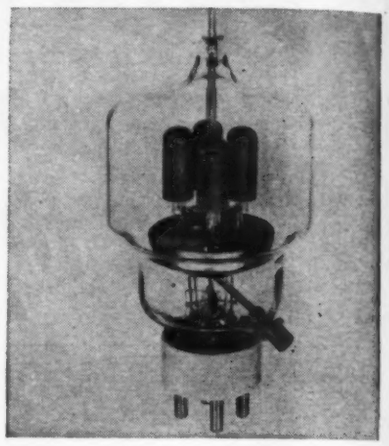
Alvey-Ferguson

METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

disks can be furnished—Lucite for general applications, and Pyrex glass for hot or corrosive fluids. Schutte & Koerting Co., 12 South 12th St., Philadelphia 7.

Vacuum Tube

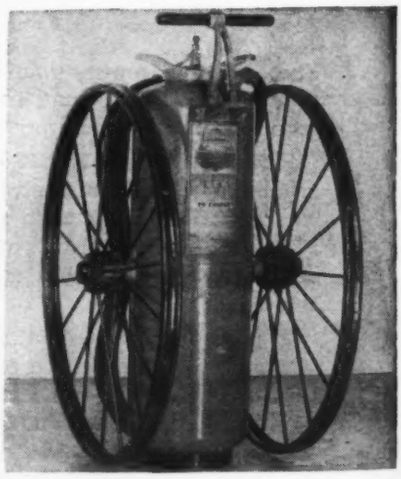
Type 304TL (3-300B2) multi-element Triode incorporates design plate and non emitting grid which are claimed to insure maximum tube life and high efficiency. Characteristics of the vacuum tube in-



clude suitability for industrial heating, television, and other applications. Eitel McCullough, Inc., 478 San Mateo Ave., San Bruno, Calif.

Fire Engine

Extinguishing hot oil fires without danger of reflash is function of the Foamite Challenger 40 gallon engine, according to its manufacturer. Engine is claimed to pro-



duce over 450 gallons of foam in less than 3 minutes. Its features include a metering device, and foam said to be tough, tenacious, and lasting. Equipment is approved by Underwriters and Factory Mutual Laboratories. American - LaFrance - Foamite Corp., Elmira, N. Y.

Salt Tablet Dispenser

Plastic salt tablet dispenser is now available to industry for utilization where hot working conditions are prevalent. Made

GRAPHITE GUS SAYS:

GRAPHITE the "HOT SPOTS"

and you'll have no lubrication problem

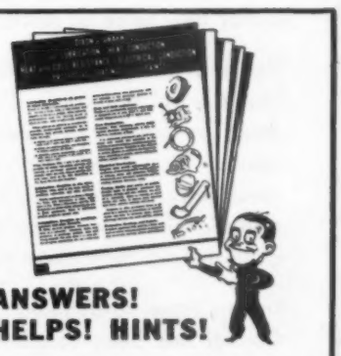
Dixon's Graphited Greases and Oils handle excessive heats, pressures and speeds ordinary lubricants can't cope with

Dixon's Cup & Pressure Gun Graphited Grease. This all-purpose water-insoluble lubricating grease does a super lubricating job under all conditions of extreme heats and pressures. Why? Because the lubricating flake graphite in it coats metallic surfaces into sleek frictionless surfaces that resist wear. Data sheet #13 tells "where and how".

Dixon's L & P (Lubricating and Penetrating) Graphited Oil. A long-lasting oil combining exceptional qualities. It gets in where ordinary oils can't. It deposits a tough, oily graphite film to fight-off friction. Lubricating flake graphite fortifies it for extreme heat conditions. Also works fast in loosening rust-tight assemblies. Data sheet #16 "tells all".

Dixon's Auto-Marine Packing and Cup Graphited Grease. A heavy-bodied bearing packing grease of maximum stability under extremes of both heat and cold. Will not thin down, wash out, or emulsify in fresh or salt water. Graphite gives it a stamina that ordinary greases can't equal. Data sheet #17 gives details.

Dixon's Graphite SlipStik. This little 3-inch cylinder has 1001 uses throughout plant, office, home,—wherever quick, handy rub-on lubrication is needed. Won't leak out or gum up. Data sheet #25 tells about it—but, why not stop in at your supply or hardware store and pick up one—15¢



ANSWERS! HELPS! HINTS!

Want help on tough lubrication problems? Send for these illustrated data sheets and see how and where Graphite will help you do a better job. Write Graphite Gus.

JOSEPH DIXON CRUCIBLE COMPANY

DIV. 44C9 — JERSEY CITY 3, NEW JERSEY

40 years of valuable experience can mean the difference between success and failure when it comes to solving the intricate problems of Industrial Dust Control.

Pangborn Corporation has that 40 years of valuable experience and offers its benefits to you for application to *your* problems,—no matter how large or small.

The two installations pictured above show the flexibility of our Dust Control program. The large one is a giant "CH" Collector, doing an efficient, economical job and occupying a minimum of space. · In the insert is our new "CK" Unit Collector which was specifically designed to handle small air volume dust requirements of industrial operations. Into both of these collectors have gone the research and knowledge of our 40 years experience.

During these hard-hitting, war production times, the value of Dust Control has been forcibly brought home to a great many alert industrialists. They are thinking in terms of tomorrow as well as today and realize the position of responsibility which Dust Control will occupy on the mammoth production lines of the future.

Come to Pangborn with your dust problems, for today or tomorrow, and receive—as an extra dividend—the benefit of our *40 Years of Valuable Experience.*

PANGBORN

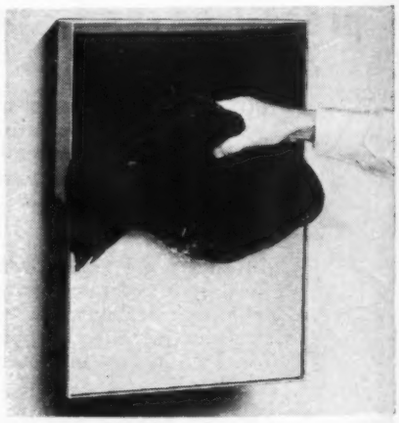
WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

of high-pressure molded reinforced bakelite, it is resistant to fracture, is corrosion and moisture-proof, and provides lasting service, manufacturer says. Featuring easy one-hand operation, it dispenses one tablet at a time with each fractional turn of knob. Has 1500-tablet capacity. Standard 10-grain sodium chloride tablets or combination sodium chloride and dextrose tablets are available for use with unit. Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8.

Emergency Blanket Case

Keeping an emergency or first aid blanket ready for use in clean, sanitary condition is the function of a case now on the market. It is 15 x 12 x 5 inches, and large enough to store a 62- x 84-in. woolen blanket. Flat against the wall like a bulletin board, it allows adequate passage room



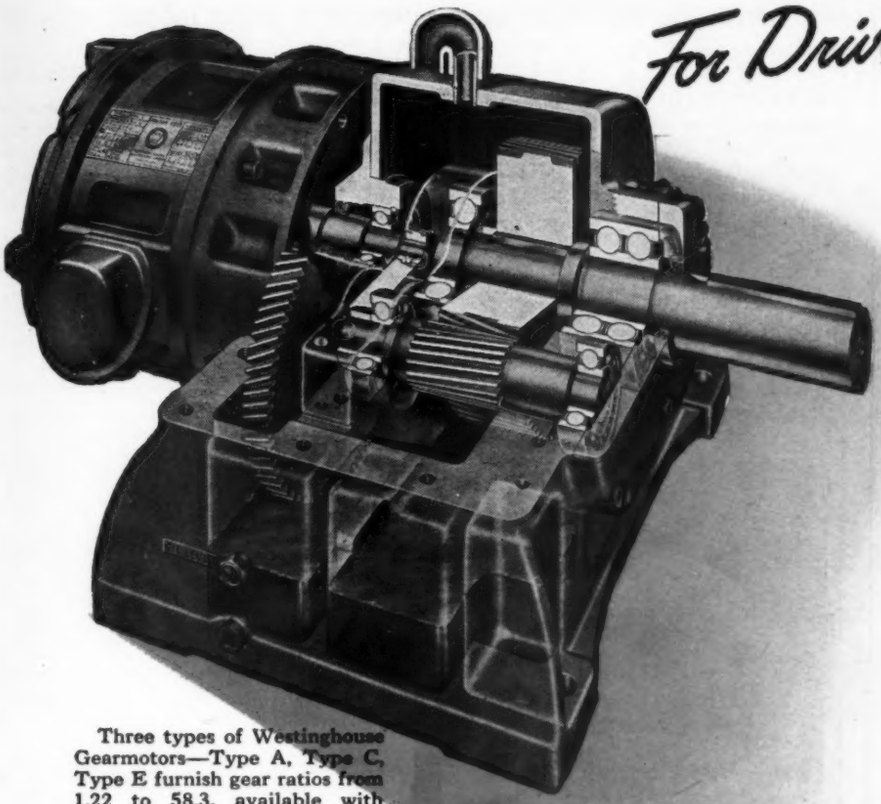
if mounted in an aisleway or confined area. Hinged cover opens easily and wide for quick access to blanket. Can be supplied with or without blanket. Universal Safety Equipment Co., 700 South California Ave., Chicago 12.

Snap-On Apron

Fabric apron features sliding snap fasteners, called Snap-Strap. The application of web straps with snaps permits easy adjustment, and apron can be instantly removed if caught in moving machinery. Made in several styles and sizes in both the bib and waist types. Impregnated with StaSafe Compound and cured, aprons are claimed to protect against acids, caustics, solvents, flame, oils, and paints. Standard Safety Equipment Co., 232 West Ontario St., Chicago 10.

There is a Westinghouse speed reduction unit for most application needs

For Drives of 1 to 75 h p



Three types of Westinghouse Gearmotors—Type A, Type C, Type E furnish gear ratios from 1.22 to 58.3, available with single-phase, polyphase and direct-current motors.

HERE ARE 9 GOOD REASONS WHY YOU SHOULD INSTALL WESTINGHOUSE GEARMOTORS:

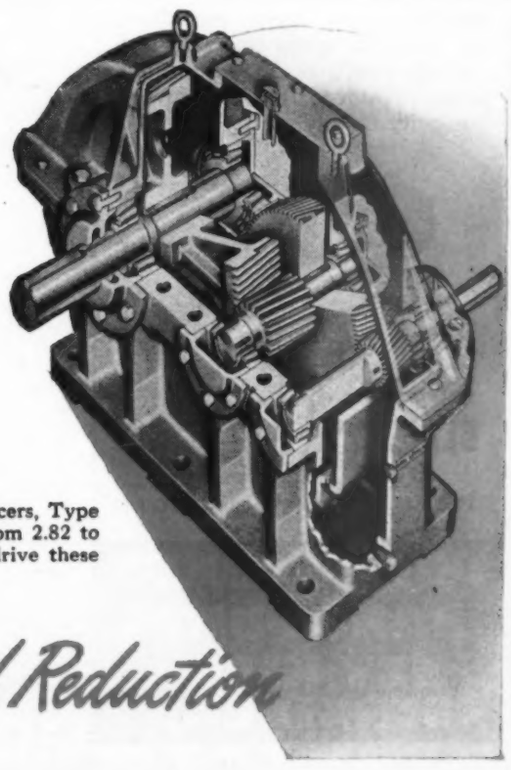
1. FEWER PARTS TO WEAR.
2. BPT "TOUGH-HARD" GEARS AND PINIONS.
3. USE ALL WESTINGHOUSE MOTOR TYPES.
4. HIGH EFFICIENCY.
5. POSITIVE LUBRICATION.
6. EASY ACCESSIBILITY.
7. IMPROVED FOUNDATION STABILITY.
8. MOTOR AND GEARS BUILT BY ONE MANUFACTURER.
9. DESIGNED AND APPLIED TO A.G.M.A. STANDARDS.

For Drives up to 1000 h p

Here are seven good reasons why you should install

Westinghouse Speed Reducers

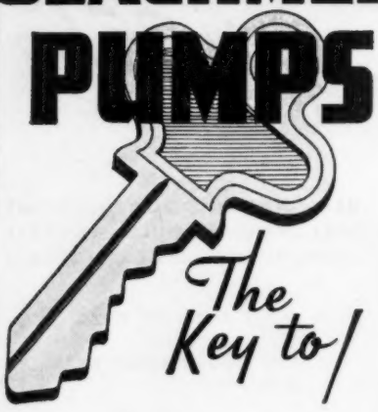
- Antifriction bearings
- Simple, positive lubrication
- Heat-treated helical gearing
- Liberally proportioned gear cases assure alignment of rotating parts
- Low power loss for high efficiency
- Rugged case—split construction for easy accessibility
- Hob cutting assures high precision gears



Two major types of Westinghouse Speed Reducers, Type SH and Type DH, offer speed reduction ratios from 2.82 to 70.5. Westinghouse also furnishes the motor to drive these units—for a complete installation.

4 out of 5 drives need Speed Reduction

BLACKMER PUMPS

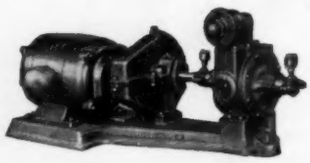


- **Lower Pumping Costs**
- **Sustained Pumping Capacity**
- **Pump Dependability**

Write for Bulletin No. 306

FACTS ABOUT ROTARY PUMPS

which explains why the "Bucket Design" (swinging vane principle) maintains pumping capacity by automatically compensating for wear and how the buckets, when finally worn out, are easily replaced and the pump restored to its normal capacity.



SERVING INDUSTRY FOR OVER 40 YEARS

BLACKMER PUMP CO.
2100 Century Avenue
GRAND RAPIDS 9, MICHIGAN

POWER PUMPS
HAND PUMPS
EZY-KLEEN STRAINERS

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• SHORT COURSE of instruction in management of small business is designed primarily for returning service men and women. Opens October 27, and continues to December 21. Director of Admissions, Columbia University, New York 27.

• PRINTED PLASTIC PLATES are for signs, dials, and similar use. Application of solvent causes plates to adhere to most surfaces, including irregular. Fluorescent and phosphorescent letters available. Pennsylvania Plastics Corp., 5025 Liberty Ave., Pittsburgh 24.

CIRCULAR FLUORESCENT LAMPS with numerous industrial applications such as on machine tools and inspection equipment where elimination of shadows is desired, are to be available soon. Technical data on request. General Electric Co., Nela Park, Cleveland 12.

• CONTROLLING CHEMICAL HAZARDS will be title of new series of government bulletins published in cooperation with Manufacturing Chemists Association. First of series will deal with ammonia. V. A. Zimmer, Division of Labor Standards, Department of Labor, Washington 25.

• FLAMEPROOFING TREATMENT for tents, clothing, and other textiles, also imparts resistance to water, weather and mildew. Ingredient is Clorafin 42 and 70, a chlorinated paraffin. Hercules Powder Co., Wilmington.

• DIMENSIONAL QUALITY CONTROL technique including formulas is described in booklet offered by Federal Products Corp., Providence 1.

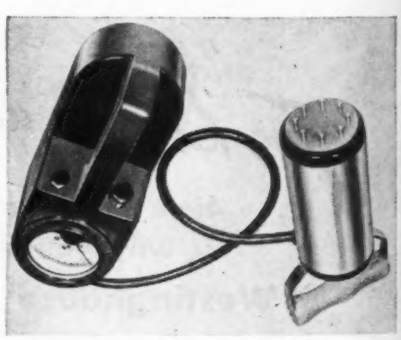
• ALLOY FOR VALVE FACINGS contains nickel, chrome, cobalt, and tungsten. Producer claims alloy has much longer life than other materials used for this purpose. Eaton Manufacturing Co., 9700 French Rd., Detroit.

• PRACTICAL DESIGN FOR ARC WELDING, third and final volume of a series, includes numerous isometric drawings to illustrate right and wrong applications. $3.50 per volume. Hobart Brothers Co., Troy 1, Ohio.

• IDENTIFICATION LABELS are designed for marking wires, conduit, and pipes with standardized symbols. Adhesive coated strips are easily attached. Different styles. W. H. Brady Co., 2906 E. Linwood Ave., Milwaukee 11, and Western Lithograph Co., 600 E. Second St., Los Angeles 54.

• STIFFNESS GAGE is usable on flexible materials up to $\frac{1}{8}$ inch, such as plastics, cardboard, metallic sheets, and wire. Taber Instrument Corp., 111 Goundry St., North Tonawanda, N. Y.

• CASTINGS REJECTED for porosity or pinhole cracks can be salvaged by application of a cast-seal solution under pressure. Improved equipment for process announced by Metallizing Company of America, 1330 West Congress St., Chicago 7.



TESTING MOISTURE CONTENT of materials with curved, rough, or flat surfaces, is given high accuracy by use of a moisture register with spring-cushioned buttons to maintain contact with contours. Typical uses include testing lumber, paper rolls, textiles, and plaster. Moisture Register Co., 133 North Garfield Ave., Alhambra, Calif.

• UNITED NATIONS CHARTER, also known as San Francisco Charter, reprinted as pocket-size booklet. Available to executives on letterhead request. George Spatta,

SUN DIESEL LUBRICANT... Ends Carbon and Gum Formation... Eliminates Sticking Valves... Lasts 50% Longer

Carbon and sticky deposits were black marks in the power-picture of an eastern candy-maker. In the operation of an eight-cylinder Diesel, direct-connected to an electric generator, he was using a well-known brand of Diesel lubricant which was changed every 200 hours.

Frequent shutdowns were scheduled for carbon-cleaning, for freeing stuck valves, and for general engine-repairs.

The difference in lubricants was soon proved when a Sun Oil Engineer studied the operating-conditions and recommended a Sun Diesel Lubricant for that particular type of Diesel engine.

Fifty percent increase in oil-life was noticed with the new oil in the crankcase. Oil-changes were soon scheduled every 300 hours instead of 200. Shutdowns for stuck valves, sticky deposits, and carbon-trouble due to faulty lubrication, were eliminated. These facts are typical of the results being obtained in all kinds of plants and all types of machines with Sun Industrial Lubricants and Sun Engineering Service. For power-equipment, compressors, machine-tools, hydraulic systems . . . in mills, mines, and factories . . . there's a Sun Product to help speed production and cut costs. Write for full details to . . .

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News Voice of the Air—Lowell Thomas

SUNOCO

SUN INDUSTRIAL PRODUCTS

OILS FOR AMERICAN INDUSTRY

EVEN JUNIOR CAN'T DENT IT—IT'S MADE OF ROEBLING STRIP STEEL!
BETTER TELL SALLY TO GIVE UP TOO—THAT'S ROEBLING ELECTRICAL WIRE
JACK MARROW

Roebling produces every major type of wire and wire product . . . house wire to telephone cable . . . bridge cable to wire rope . . . fine filter cloth to heavy grading screen . . . strip steel and flat wire to round and shaped wire . . . all Roebling products. *All* the result of over 100 years of wire specialization.
John A. Roebling's Sons Company, Trenton 2, N.J.

JR ROEBLING

ROEBLING

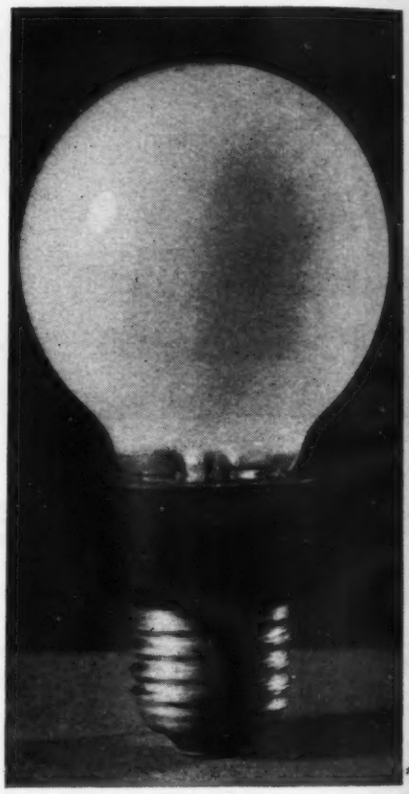
PACEMAKER IN WIRE PRODUCTS

WIRE ROPE AND STRAND • FITTINGS • SLINGS • SUSPENSION BRIDGES AND CABLES
COLD ROLLED STRIP • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS
AIRCORD, SWAGED TERMINALS AND ASSEMBLIES • AERIAL WIRE ROPE SYSTEMS • ROUND AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES • WIRE CLOTH AND NETTING

president, Clark Equipment Company, Buchanan, Mich.

• VIBRATORY HYDRAULIC PRESSURE permits adjustment of a press to make any number of repeated pressure strokes instead of a single continuing squeeze. Pressures range from 1600 to 8000 pounds. Speed of strokes also is predetermined by adjustments. Denison Engineering Co., 1186 Dublin Road, Columbus, Ohio.

• REFRACTORY MATERIAL for coating interior brickwork of boilers, is known as Zircoat-M. Has zirconium silicate base and is applied by spray gun. Coatings of $\frac{1}{8}$ to $\frac{1}{4}$ inch are said to prolong operations between repairs as much as two to eight months. Basic Refractories, Inc., 845 Hanna Bldg., Cleveland.



SHOCK ABSORBING LAMP, used on warships, has many possible applications in industry. Bulb is specially mounted in rubber to protect both the glass and the filament. General Electric Co., Nela Park, Cleveland

• NEW SAFETY COLOR CODE for marking physical hazards is announced by American Standards Association. The objective is to standardize nationally all colored markings for protective purposes. Copies at 25 cents. American Standards Association, 70 East 45th St., New York 17.

• AMAZING ELECTRON is title of booklet illustrated with cartoon technique to explain basic facts of electronics. For distribution to educators, consumer organizations, farm groups, labor unions, and public. Electronic Corp. of America, 45 West 18th St., New York 11.

Wire ahead

Don't handicap tomorrow's equipment with yesterday's wiring

IT'S A FACT that inadequate wiring can reduce equipment performance by twenty-five to fifty per cent. This is true right now—and think of your greatly expanded electrical future!

Remember, wiring comes *first!* Foresighted wiring based on future needs—not tied to formulas of the past.

It costs nothing to review your wiring plans now. But it may cost plenty for shutdowns, teardowns to permit extensive alterations later.

Make a note of it: Check wiring plans! Call in your consulting or plant power engineer—electrical contractor or power salesman. Let them help match your wiring to future production hopes. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company. General Offices: 25 Broadway, New York City 4. Chicago Office: 20 North Wacker Drive 6. Sales Offices in Principal Cities.

HELP BRING VICTORY SOONER . . . BUY MORE WAR BONDS

ANACONDA WIRE & CABLE COMPANY

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Significant Labor Developments

BENJAMIN WERNE, Lecturer in Government Regulations, New York University, Member of the New York Bar

Period Surveyed: July 1 to August 1

TREND INDICATORS

Injunction Restraining Employment

The fact that a company employs homeworkers without proper certificates is sufficient grounds for the issuance of an injunction restraining such employment. The administrator need not prove other violations to secure the injunction. (Walling vs. Landau, USDC, S.N.Y.)

Penalty for Employing Minors

As of October 1, 1945, employment of girls under 18 is forbidden on all government contracts in excess of $10,000. Where, however, there are girls working on a contract on October 1, their employment with the same contractor may be continued indefinitely subject to the conditions previously required. Illegal employment of minors will result in a penalty of $10 each day for each minor so employed.

Held Under Walsh-Healey Act

A textile company's "second hands," on the ground that the employees involved spend a substantial portion of their time in productive work, were neither "foremen" nor "executives," and aside from their supervisory duties they were engaged in "fixing" and in repairing machinery.

Maintenance employees of an oil refinery cleaning and repairing stills from time to time despite the fact that they are not engaged in the manufacturing of goods and work only when the stills are closed down. (Lion Oil Refining Company)

"Industrial Homeworkers" Under Wage-Hour Law

Employees furnishing a radio rating firm with tabulations were deemed industrial homeworkers under the Wage-Hour Law. Warning was therefore issued to the firm involved and to similar firms that maintenance of federal homework handbooks showing hours worked was requisite in keeping with the provision of the Wage-Hour Law. Companies in such a position are advised to secure from the Wage-Hour Divison a handbook for each employee on whch the employer is to record the time work is given out and received. The handbooks, except for the period when entries are made, are to be retained by the employee until requested by the division.

Held Under Wage-Hour Law

On a finding by a Circuit Court of Appeals that a watchman's services were so intimately connected with the material which passed into interstate commerce and that the transportation of the equipment was essential to production of goods in which the employer was engaged, the court held the guarding service necessary to such production. It therefore held the watchman entitled to the benefits of the Wage-Hour Law. (Engelbretson vs. E. J. Albrecht Company, CCA-7)

Building service and maintenance employees of an office building, of which nearly 40 percent was occupied by tenants producing goods for commerce. (Baldwin vs. Emigrant Industrial Savings Bank, CCA-2)

Employees in the central administrative and supply offices servicing a chain of motion picture theaters in five states by keeping all accounts and records, conducting all publicity and personnel affairs and arranging for the transmission and exhibition of films for all theaters serviced. (Walling vs. Paramount-Richards Theaters, Inc., USDC E. La.)

Held Not Under the Act

Employeecs of an ordnance plant who were employed before actual production of ammunition began since their training, assistance in training and installing machinery were but preliminary steps to production and not necessary to the production of the goods. (Anderson et al. vs. Federal Cartridge Corporation, USDC Minn.)

Held Exempt as Administrative

An office manager and a bookkeeper of livestock commission companies despite the fact that they do not constantly and continually exercise "discretion and independent judgment." The contention that the men were performing manual work by making bookkeeping entries was discarded by the court which held that an office manager, being paid not less than $200 a month, may also keep books and still be exempt from the act. (Walling vs. Newman; Walling vs. Gehan, USDC N. Iowa)

(Continued on page 222)

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WAR LABOR BOARD

*Automatic Progression Ordered

If the parties fail to agree on the performance criteria governing wage progression within rate ranges, the WLB announces that it will order quasi-automatic progression up to the mid-point of the range and leave further progression to the top of the range to the company's discretion with the possibility of appeal through grievance machinery. The burden of proof in showing why an employee should not be promoted to the mid-point lies with the company, while the union must prove that the failure to promote from the mid-point on was arbitrary or capricious on the company's part.

*Reconversion Guides

The WLB approved an employer's new wage rate schedule based on the "guides" issued by the board for plants in reconversion. Under the new schedule, earnings will be increased 5.3 percent above piece rate incomes received before the plant converted and 10.97 percent over average overtime earnings. The company retained the rates for the key jobs common in both war and peacetime production, and filled in rates for other jobs as related to the key jobs. (Lester Piano Manufacturing Company, RWLB-III)

*Increase Granted

A Little Steel increase was granted to a company's returned employee-veterans and employees who worked in a war plant. The WLB, however, ordered the company to offset any wage adjustments which might have been granted these two groups of employees between Jan. 1, 1941 and the time they left the company's employ against the 15 percent increase (Coca-Cola Company, RWLB-III)

*Increase Ordered

Despite the existence of a dispute, a RWLB directed an increase of 5 cents an hour in the piecework guarantee granted employees so that the employees' straight-time hourly base rates would be equal to their guaranteed rates in the event their production falls below par. The board explained that such an increase did not constitute a fundamental change in the plan. (Associated Producers and Packers, Inc., RWLB-XII)

*Shift Differential Awarded

Affirming a RWLB's decision, the National Board awarded shift differentials to bakery employees in line with the Basic Steel decision retroactive to a date more than six months before the date of the Basic Steel decision. The board conceded that, although the differential could not have been granted prior to the Basic Steel decision, the latter caused a reversal in its policy and henceforth premiums could be paid in new industries despite the lack of industry-area practice. The board upheld

* In this and the following classification items marked with an asterisk also are considered to be trend indicators.

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A dry, odorless gas, carbon dioxide cannot damage delicate equipment or conduct electricity. It leaves no liquids or stain to clean-up—no shutdown from water damage.

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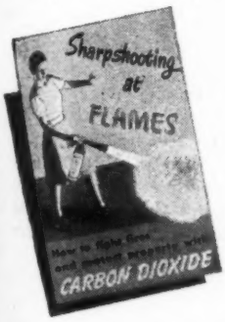

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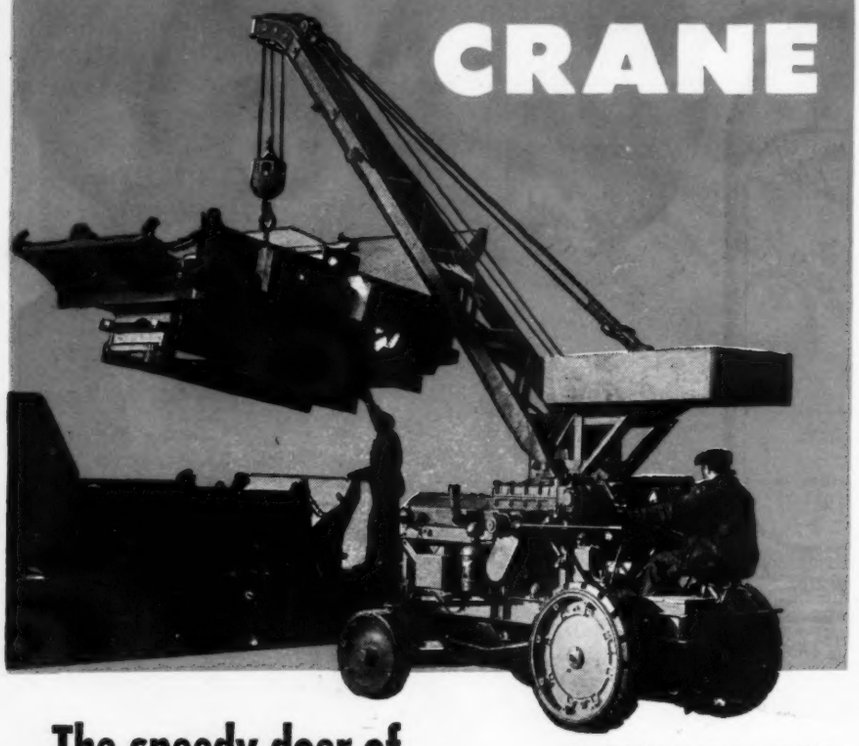

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ROUSTABOUT CRANE

Roustabout Cranes
By Hughes-Keenan
Load-Handling Specialists Since 1904

the retroactive phase of the award on the grounds that the Basic Steel award was retroactive and that the steel decision was not a change in stabilization policy. (Spaulding Bakeries, Inc., WLB)

To compensate field service workers for the inconvenience of travel and hotel accommodations, of living away from home and working without supervision, a RWLB awarded premium pay for work done away from the plant. The board based its decision on the theory that the inconvenience of such work was parallel to that of night work for which premiums are paid. (Economic Machine Company, RWLB-I)

On the ground that the Basic Steel decision was a change in WLB shift policy, a RWLB permitted the reopening of a contract. The contract provided that negotiation could be reinstituted should the WLB's wage stabilization policies be altered. Having the contract reopened, the board directed the payment of shift premiums for first and second shifts in accordance with industry practice.

On the other hand, a RWLB refused to reopen a contract on the union's claim that a change in wage brackets for a certain industry constituted a change in board policy. The board stated that such a change was made under its going wage rate policy rather than a redetermination of policy. (California Spray-Chemical Corporation, RWLB-X); (Patterson-Kelly Company, Inc., RWLB-III)

Statutory exemption from the Wage-Hour Law does not immunize an employer from a WLB's order to pay premium earnings under its stabilization policies. Thus a group of milk condenseries were obligated under a WLB directive to pay premium rates for all hours worked in excess of 40 a week or 8 a day on the board's finding that such was industry-area practice. The board pointed out that, although the directed payment was not mandatory under the act, it was not prohibited by it. (Wisconsin Milk Condenseries, RWLB-VI)

*"Rare and Unusual" Increase Continued

WLB permitted the continuation of "rare and unusual" wage rates after the company reverted to peacetime production where these same rates had been previously approved by the Wage Adjustment Board for civilian production. (Bowen & McLaughlin, RWLB-X)

Increase Denied

A second "rare and unusual" increase was denied to the lumber workers of the plywood and veneer industry on the ground that the first increase had an unstabilizing effect, and that plywood and veneer are not as badly needed for the war effort as when the first award was made. (Atlas Plywood Corporation, RWLB-VI)

*Bonus Rules

If an employer had prior to October, 1942, a bonus plan under which a definite percentage of profits was set aside each year to be distributed within his own discretion to certain key employees on the basis of their contribution to the success of

3 million footsteps..

4 long years..

all kinds of weather

Yet this RUBBERLIKE FLOOR RUNNER IS STILL GOING STRONG!

Success stories of Rubberlike Floor Runner continue to pour in from satisfied users — like the Bridges Furniture Company of Columbia, S. C. In countless other heavy traffic spots, this low-cost, long-wearing composition runner is keeping floor maintenance costs down.

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SKID-PROOF · QUIETS TRAFFIC · HUGS ANY FLOOR
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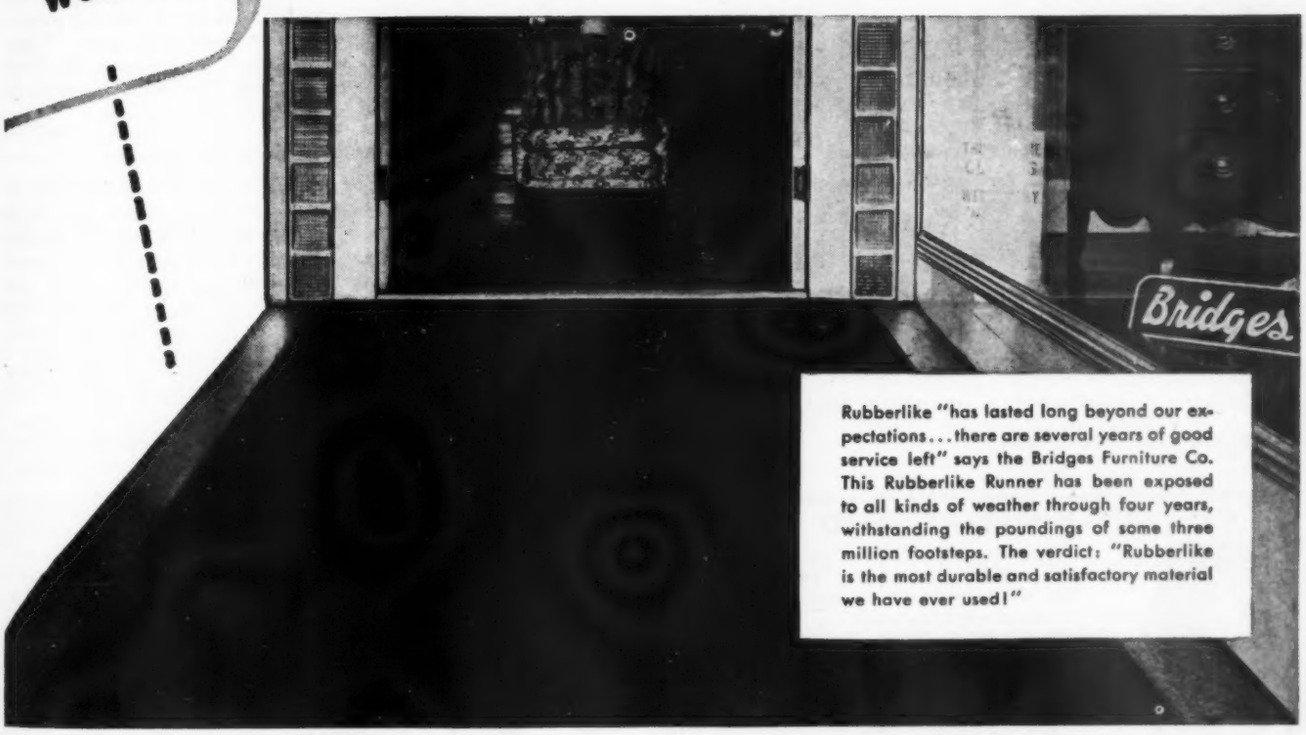

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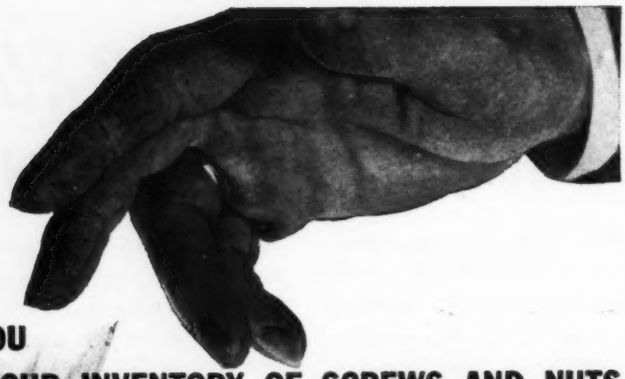

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92% IMMEDIATE DELIVERY ... *here's our Ante*

It's going to be a fast game from now on, *and we're staying!* So are you . . . *if you start now to build an inventory large enough to supply momentum.*

For unless you can *roll along*, you may be stalled in the months to come!

Why? Because we're fighting a war in which *transportation* by rail, truck and air can become the bottleneck unless Uncle Sam has the right of way.

Why? Because we're reconverting from war production, where speed was the essence, to mass manufacture of peacetime goods where every penny counts.

Wholesale Distributors who start *now* to build an inventory will be in the best position to handle their orders promptly, completely—and economically.

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Corbin is still producing for war . . . but our facilities today enable us to offer 92% IMMEDIATE DELIVERY for those important inventories needed now to prevent congestion later. Don't wait—or you may be kept waiting!

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Wood Screws, Machine Screws, Hardened Sheet Metal Screws, Self-Tapping Machine Screws, Stove Bolts. Aircraft Screws to government specifications . . .
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Screws Nuts Chain

LABOR DEVELOPMENTS *(continued)*

the business he may now reinstate these bonuses without approval for 1945 and subsequent years. But the percentage used in determining the bonus fund or the basis for distribution must remain unchanged. Adjustments may also be made for the year 1944 to conform with the original bonus plan if the *total* payments to the employees are not in excess of the bonus fund as determined by applying the bonus plan to 1944 profits.

*Bonus Reinstated

A bonus discontinued by the company to offset a wage award by a RWLB was ordered reinstated retroactive to the date of its discontinuance. The board pointed out that the bonus must be considered an integral part of the employees' wages since the same amount has been paid through the years despite fluctuating profits and since discontinuance of the bonus would serve to nullify the board's award of wage increases. (Tucker Duck & Rubber Company, RWLB-VII)

*New Bonus Regulations

Amended salary stabilization regulations remove the dollar limitation on discretionary bonuses provided no change in the method of determining the bonus fund based on a fixed percentage of profits, sales, and the like, or in determining the amount payable to each employee has taken place. These changes are retroactive to cover the fiscal and calendar years ending subsequent to Dec. 31, 1943.

*Severance Pay Awarded

On the ground that the publication of trade papers is in the same category as the newspaper industry, a RWLB awarded severance pay in a dispute case to the employees of trade papers. The award, less than that made by the papers under their union contracts, provided for one week's pay for each month of service, with a maximum of ten weeks' pay. (Wid Film & Film Folk, Inc., RWLB-II)

*Incentive Guarantee Ordered Continued

Discontinuance of an incentive guarantee was disallowed by the WLB on the ground that such would be tantamount to a wage reduction in violation of the Wage Stabilization Act. The guarantee had been instituted at a time when the incentive system was in the experimental stage, and was now, in the company's opinion, no longer needed since the system was perfected and employees would not lose production because of conditions beyond their control. (Curtiss-Wright Corp., WLB)

Board Approval Unnecessary

WLB approval need not be secured to pay employees discharged without cause any accrued portions of their vacation benefits or non-production bonuses if such payments are on a pro-rata basis. In the absence of a pro-rata plan, however, board approval must be had.

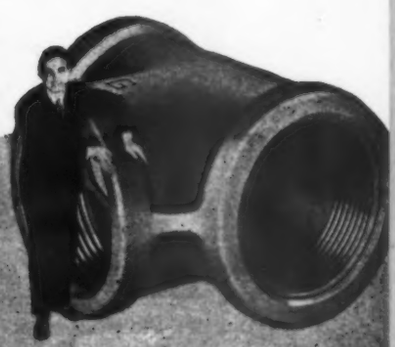
Vacation Denied

On the ground that it was contrary to the

ix Pipe Line Breaks Before They Happen

The Man With The Pipe Wrench avoids time-wasting grief with Grabler Square "Gee" Fittings.

Sturdy Truss Resists Stress and Strain — affords an extra margin of safety.



Husky Bead prevents distortion of fitting under wedging action of wrench.

PIPE lines are unpredictable when it comes to springing a leak at unexpected places. Not even your plant maintenance men can forestall them all. But due to his keen eye and sound judgment, accidents to men and equipment have been reduced, and the cost of pipe line maintenance lowered by his vigilance in looking for trouble where trouble is likely to occur, and fixing it quickly with good tools, good pipe, and pipe fittings. Good pipe fittings—Grabler Square "Gee" Fittings—avoid time-wasting grief for The Man With The Pipe Wrench, because their precision-cut threads make up quickly and easily and make tight joints that stay tight... Smooth chamfering aids fumble-free starting in hard-to-reach places. Truss construction and uniformly rugged body structure leaves no vulnerable points of weakness out of which a future emergency may arise. Their husky beads provide a solid grip for the strenuous wrench work. Assure continuous pipe line operation for air, steam, gas, lubricants, and liquids in both plant and machine operation—use Grabler Square "Gees" to make safe, trustworthy connections.

Smoothly Chamfered, Clean-Cut Threads for leak-proof joints.

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Balanced Structure, Uniform Wall Thickness for years of faultless service.

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Billions of feet of lumber are still needed to fight the war. But war plants are part of our fighting force and lumber for critical plant maintenance and repair can be had. Write us for the names of suppliers who may be able to handle your order. Chemicals for treating are available at all our plants.

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practice in seasonal industries and that it would prove unstabilizing in both the area and industry, a RWLB denied a union's request for the standard one for one and two for five vacation plan in the seasonal fruit and vegetable packing industry. (C. B. Williams Company, RWLB-VIII)

*Sick Leave Awarded

Because of the especially hazardous nature of the work and because most of the injuries sustained on the job were of too short a duration to be covered by applicable state laws, a RWLB awarded a sick leave plan in a dispute case to meat cutters and butchers in a city's grocery stores. The plan called for straight-time pay for any time lost during a regularly scheduled workweek (not exceeding four days in a workweek) because of injuries incurred on the job. (Employers' Negotiating Company, RWLB-VI)

*Sick Leave Plan Approved

Declaring that voluntary sick leave plans need not conform to industry-area practice to be approved, the WLB approved such a plan which fulfilled the "reasonableness" test. The plan provided for sick leave payments commencing after the first 7 days of non-occupational illness in the amount of full weekly pay for a specified number of weeks and half-week pay thereafter. The total amounts were to range from 4 to 26 weeks' pay on the basis of length of service. (Glidden Company, WLB)

*Fringe Increase Ordered

Contrary to the practice in the region, a RWLB ordered a small independent meat packer to furnish all special work clothes, tools, and safety devices free to its employees. (Abraham Bros. Packing Company, RWLB-IV)

*Wage Decrease Permitted

As interpreted by the WLB's general counsel, wage decreases may be made by the board down to the 1942 level in the same manner that the board is permitted to make increases. The board is bound by the Stabilization Act which permits such changes as are necessary to aid in the effective prosecution of the war or to correct gross inequities. In the case of decreases below the 1942 level, the board is limited to a finding that such a change is both necessary to aid in the effective prosecution of the war and to correct gross inequities.

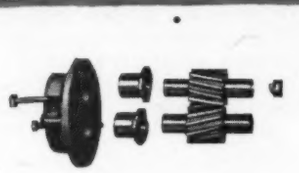
No Equality of Pay

Where women employees' productivity was proved to be generally lower than men's, the employer was not compelled to equalize the guaranteed base pay of the two. The company pointed out, however, that in the case of piecework earnings women with equal ability received the same compensation as men since the piecework rates were identical for men and women. (Simmons Company, RWLB-X)

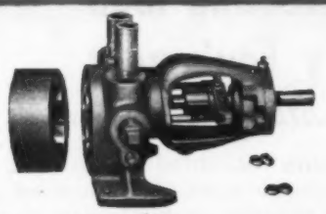
*Forfeiture Clause Awarded

Because of the failure of a company's attempt at curbing absenteeism, the WLB awarded the company a clause under which

HOW ROPER PUMPS CAN BE SERVICED WITHOUT DISTURBING PIPE CONNECTIONS OR MOUNTING

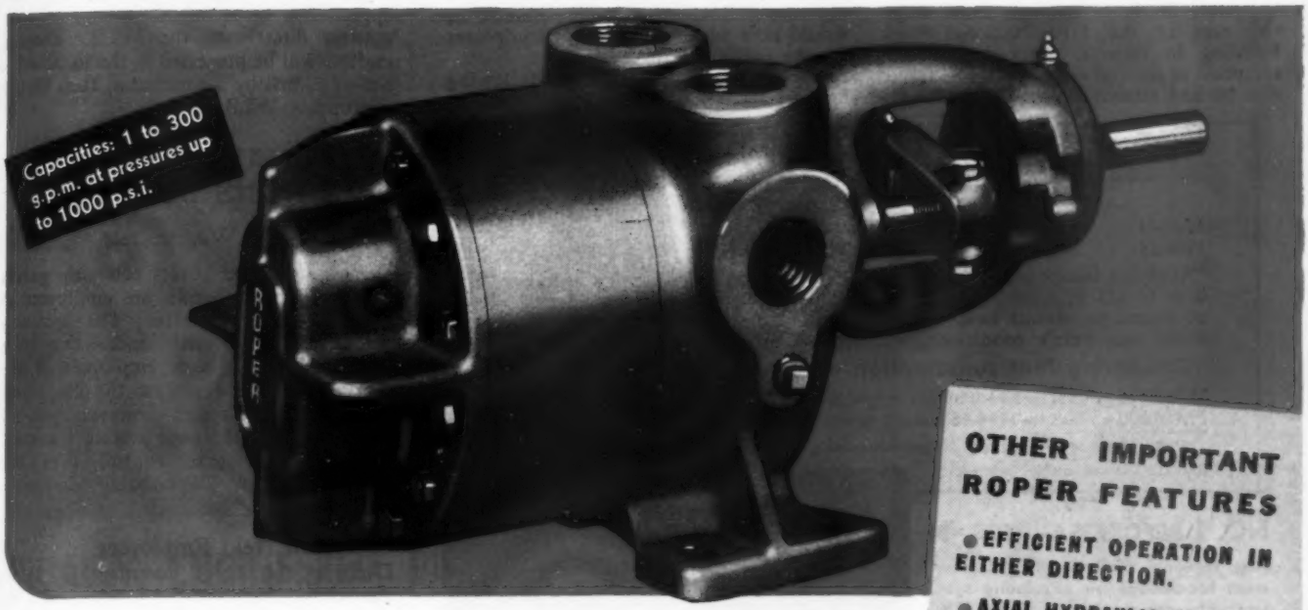


1 Two cap screws, threaded into jack screw holes, pull face plate. Front flanged bearings and gears slip out easily. Flexible slider coupling is removed thru hole in opposite bearing.



2 The gasket-sealed gear case separates from the back plate. Back flanged bearings are easy to get out. The back plate, pipe connections, mounting and power unit, remain intact.

3 Stuffing box can be replaced quickly with split-ring packing by removing 2-piece cap. Split-gland slides forward on shaft to allow clearance, serves as tamp, and is also removable.



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- AXIAL HYDRAULIC BALANCE.
- FLOATING EQUAL SIZE EXTERNAL GEARS.
- OVERSIZE BEARINGS. GEARS SUPPORTED AT BOTH ENDS.
- CONTINUOUS BEARING LUBRICATION FROM PRESSURE TO SUCTION SIDE.
- PACKED BOX OR MECHANICAL SEAL UNITS TO SUIT REQUIREMENTS.
- FREE ENGINEERING ASSISTANCE, OFFICES IN PRINCIPAL CITIES.
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First National Bank Building, Detroit, cuts heating and cooling load with Air Recovery Equipment

Saves 108 tons of coal; 1,959,075 pounds of steam

Air Recovery Equipment, employing activated carbon to adsorb airborne gaseous and vaporous impurities, is installed in existing system and 20,000 CFM of stale, contaminated air that had been exhausted is economically restored to original freshness and recirculated.

Estimated fuel savings surpassed before end of season

WHEN Merle F. Bennett, Chief Engineer of the First National Bank Building in Detroit, checked fuel consumption at the end of February, he found that he had already saved more than the 100 tons of coal it had been estimated he would save with Air Recovery Equipment for the entire heating season.
In his report, he submitted the following figures:

"Fuel consumption September to February inclusive:

	Total consumption (lbs. of steam)	Degree days	Lbs. per degree day
1943-44	29,467,100	4659	6325
1944-45	29,406,600	4959	5930

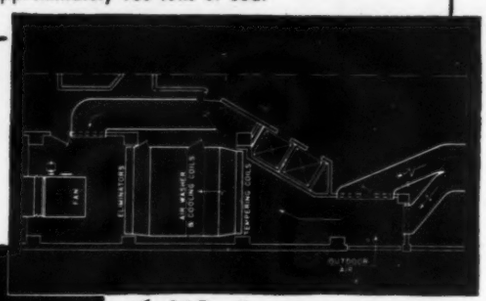
"Applying last year's 6,325 pounds per degree day to this year's degree days (6,325 × 4,959) we get 31,365,675 pounds, which is the amount of steam we would have consumed this year if we were operating under last year's conditions, without the Air Recovery Equipment.

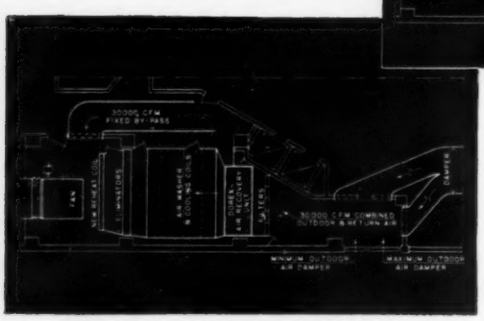
"Comparing that consumption with this year's actual:

31,365,675 pounds — consumption estimated on last year's efficiency
29,406,600 pounds — 1944-45 actual consumption
1,959,075 pounds — saved or approximately 108 tons of coal
(13,000 B.T.U. coal at 70% efficiency)"

NO. 1 BEFORE SAVINGS →

First National Bank Building Equipment rooms. The air circulating system with a fan capacity of 60,000 CFM serves the general banking area, general office space and private offices.





← NO. 2 AFTER SAVINGS

Same equipment room after the DOREX Air Recovery Equipment was installed. The activated carbon canisters purify both 20,000 CFM of recirculated air and 10,000 CFM of outdoor air as the intake air is polluted by kitchen vent stacks. This cuts the heating and cooling load by conserving the thermal values of the recirculated air.

The W. B. Connor Engineering Corporation maintains a research laboratory, a staff of trained specialists, and district representatives in leading cities whose services are at the disposal of Consulting Engineers, Architects, Air Conditioning Equipment Distributors and Plant Engineers. Our staff can assist you in figuring out the economies of air conditioning load reduction through Air Recovery, or help you apply the sound advantages of Air Purification to any operation where contaminated air threatens product quality or production efficiency.

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employees without a valid excuse would forfeit the straight-time pay provided for holidays not worked under the contract. The company, however, must give employees 48 hours' notice of holiday work and must provide the union with information regarding the government agency desiring the holiday work. (Walter Kidde Company, RWLB-II)

Procedure for Wage Adjustments

WLB has amended its rules for procedure on voluntary wage and salary adjustment applications of employers operating a government-owned facility for the War Department. These employers may now appeal War Department's rulings on such matters directly to the WLB. Dispute matters will be processed in the usual manner—i.e., first by a conciliator, then by the appropriate WLB agency.

NATIONAL LABOR RELATIONS BOARD

**Held Under Wagner Act*

The Wagner Act covers company guards who, as deputy sheriffs, are employees of a subdivision of a state. The company contended that, since under the state statute its guards were employees of the sheriff, they could not be the employees of both. The board, however, pointed out that under the same statute the company could exercise control over the guards. (Tampa Shipbuilding Company, Inc., NLRB)

**Foremen Held Employees*

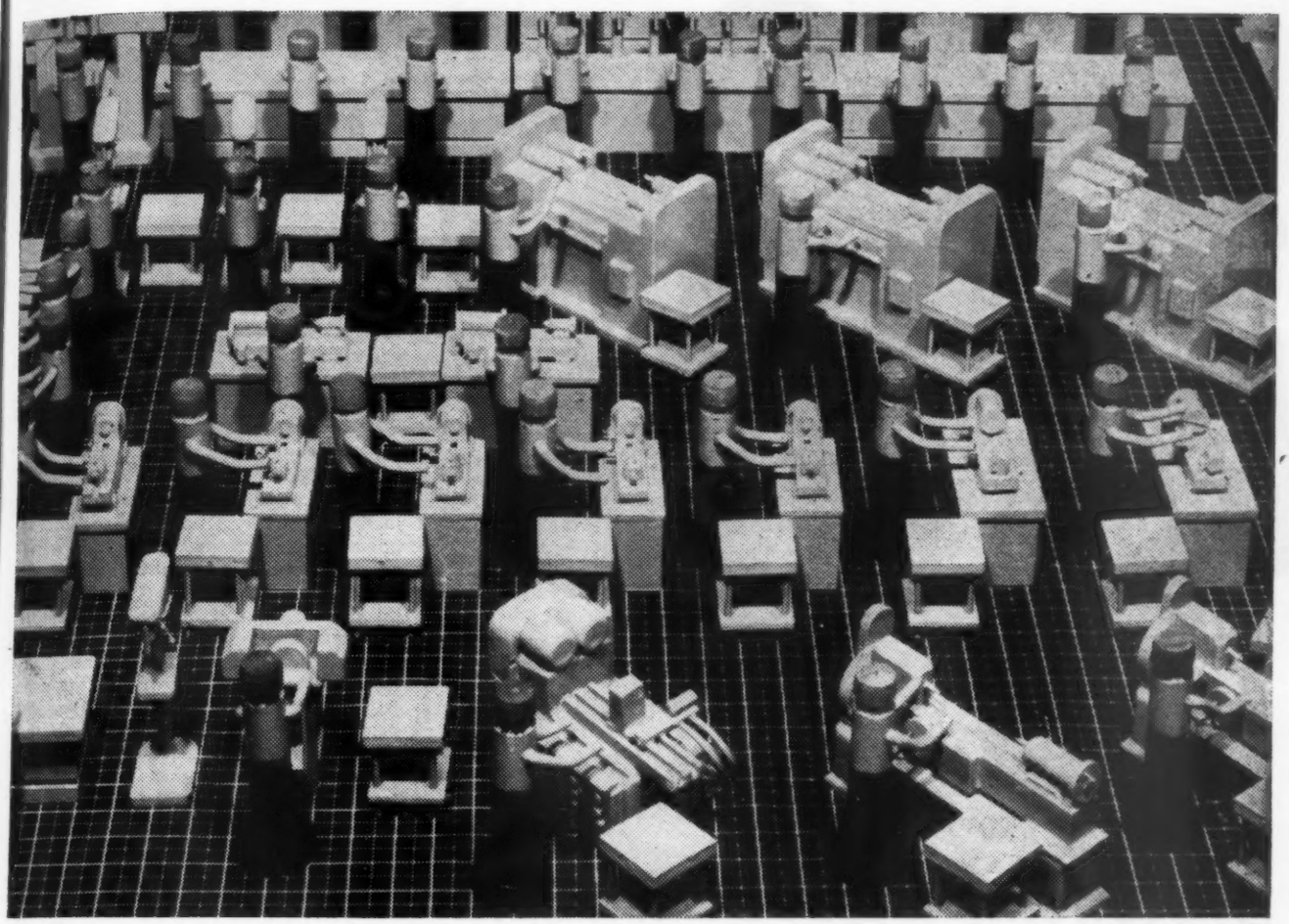
Declaring the test of "foremanship" to be the relation between the foreman and his employer and not with those he supervises, a State Labor Relations Board held a group of general foremen, foremen, and assistant foremen to be "employees" within the coverage of the NLRA. Although these foremen supervised rank-and-file employees and had the power to discharge for violation of the company's rules, the board pointed out that they would come within the "employee" classification since they neither participated in the formulation of managerial policy nor did they represent the employer in collective bargaining negotiations. (Metal & Alloy Specialties Company, Inc., N. Y. S. LRB)

**Appropriate Bargaining Unit*

Despite the fact that a group of culinary workers did not constitute a craft the New York Labor Relations Board deemed the establishment of the unit appropriate. The board explained that union organization is not sufficiently progressed as to warrant delaying recognition of this unit till the establishment of a more inclusive one. (Hotel Waldorf Astoria Corporation, N. Y. LRB)

**Right to Challenge Bargaining Agent*

Negotiation of an automatically renewable contract when no notice has been given as to the desire of reopening the contract, entitles a rival union to challenge the bargaining agent. Such negotiation is, in effect, a waiver on the union's part to have



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LABOR DEVELOPMENTS (continued)

the contract continued unchanged for another term. (Red Jacket Manufacturing Company, NLRB)

*No Forfeiture for Strike

Where employees strike in protest against the promotion of an employee without filing advance notice required by the War Labor Disputes Act, the strikers do not forfeit the protection accorded them by the Wagner Act. The history of the War Labor Disputes Act attests to the fact that Congress did not mean to abridge the rights guaranteed to labor by the Wagner Act, striking for a lawful purpose being one of them. (Republic Steel Corporation, NLRB)

*Unions Penalized for Discrimination

Failure to extend to members of a Negro local the same legal rights enjoyed by the union, while imposing upon it the same obligations as on the white employees in the same plant, was deemed discriminatory practice on the part of the union and of sufficient cause to revoke the union's certification. The members of the Negro local, although not a party to the contract between the white local and the company, were forced to comply with the check-off and maintenance of membership provisions of the contract as conditional to employment. (Larus Brothers Company, Inc., NLRB)

Held Unfair Labor Practice

An employer was held responsible for the exclusion of union members from work by an anti-union faction although he committed no other unfair labor practices. The employer was therefore found guilty of discriminatorily discharging twelve union members because he allowed such a faction to lock out these employees and even encouraged the lockout. (Brown Garment Manufacturing Company, NLRB)

*Held Domination

The extension of a no-solicitation rule during an outside union's organizational campaign was deemed a factor in finding the company guilty of domination of the inside union. The rule prohibiting solicitation on company property during non-working hours was in itself violative of the Wagner Act; moreover, when so utilized it hindered employees from transferring their union membership from the inside union to the outside one. (Keystone Steel & Wire Company, NLRB)

Provision in the Wagner Act for payment to employees for time spent in conferring with the employer during working hours may not be construed to cover payment for time spent by representatives in union meetings. Thus the NLRB held an employer guilty of domination where, among other things, he made such payment to union representatives for time spent in meetings in which the management did not participate or which were held outside the employees' working time. In another case, however, where payment was made to union representatives only for time spent in conference with the management with reference to wages and other working conditions, the board found the

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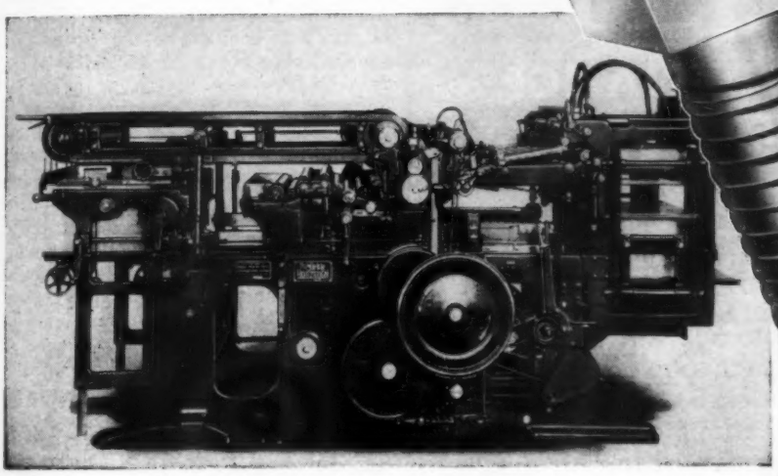

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employer clear of any charges of domination. Under the act, the board states, such payment is permissible. (Wyman-Gordon Company, NLRB; Remington Arms Company, Inc., NLRB)

Held Interference

Failure on the part of the employer to notify the union in advance of its adoption of new company rules was held by NLRB to be in violation of the Wagner Act. Under the union's contract, the company was obligated to submit all plant rules to the union for approval. Issuance of a rule-book without union approval was therefore deemed an act of interference on the part of the employer. (Alexander Milburn Company, NLRB)

Held Refusal to Bargain

Segregation of Negro and white employees into separate locals does not constitute racial discrimination to justify withholding the union's certification. The NLRB, therefore, found an employer lacking grounds for refusal to bargain with a union so organized. The parent union specifically stated representation would be conducted equally for both locals with no discrimination. (Atlanta Oak Flooring Company, NLRB)

Refusal to Bargain Illegal

An employer may not legally refuse to bargain with a union on the ground that another union has claimed majority at the time the delayed certification of the original union is made. In one case, an unfair labor proceeding delayed the union's certification nine months during which time there was a large labor turnover and another union claimed a majority. The NLRB stated that the reasonable period during which the certification is recognized as valid is immune from an election by another union. (Cheney Lumber Company, NLRB)

**Refusal to Bargain Unjustified*

The fact that an employer planned to replace the employees of an enterprise taken over from a predecessor, was deemed insufficient grounds for refusing to bargain with the union representing the employees. The board, however, did not order the employer to resume bargaining with the certified union since the employer changed the company's operation subsequent to his refusal to bargain and nearly 50 percent of the original employees were removed from the payroll. (Syncro Machine Company, Inc., NLRB)

Held Not Discrimination

Discharge of an employee for talking to other employees on the job about signing them up with the union after he had been warned about such action was deemed not discriminatory, despite the fact that the company's no-solicitation rule was found to be illegal. The board found that the treatment accorded the employee in question was no different from that given employees soliciting for a rival union on company time. (Alabama Fuel & Iron Company, NLRB)

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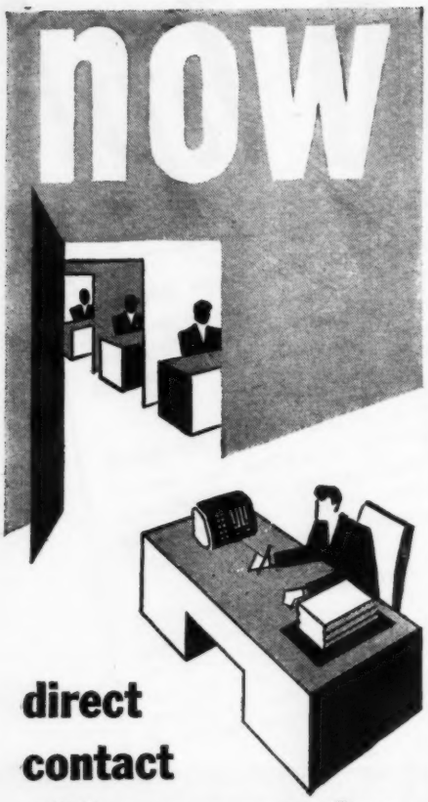

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THEY SAY AND DO

What Has Become of Discipline?

The following statement is published as an anonymous comment—a rare procedure in FACTORY*—because the author does not desire identification with material that might be construed as criticism of practice in his own organization. The editors vouch for his authority and veracity.*

A personnel man, confronted with the task of interviewing employees who were being transferred to another unit in the company and who had been informed "off the record" that they were unsatisfactory, decided that he would conduct a "Gallup Poll" to see what he could determine about any factors in the past work experiences of the individuals which might have been underlying causes related to their failure. The results were both interesting and disturbing.

More than 70 percent of these "problem" employees stated that they had never been told by their supervisors that their work was unsatisfactory. Practically all the rest admitted that they had been told their work was not up to standard, but they felt that after their correction they had improved to such a point that their dismissal was not justified. Many of them stated that they had actually been praised for their efficiency or performance.

Naturally, it would be unwise to take at face value the statement of the "more than 70 percent" who definitely charged their supervisors with failure to advise them truthfully regarding whether or not their performance was meeting the standard expected. But at the same time, the percentage is significant.

During the past few years the philosophy of some so-called "practical psychologists," which has been repeatedly emphasized to supervisors, of "always say something good to those under your direction" has had a telling effect on the truthfulness with which supervisors criticize or fail to criticize their employees. This philosophy of unintentional deceit in the handling of employee relations, if permitted to go unchecked, will result in a breakdown in the moral fiber of the industrial workers upon whom we have depended so much in the past and must continue to depend upon in the future.

Unfortunately, this razzle-dazzle "keep 'em happy" philosophy has been coupled with a concept, which the managements of many companies have attempted to instill in their supervisory organizations, that "a supervisor is judged by the employee relations existing within the organization under his direction." This concept, although conceived in the best spirit and for worth-while purposes, has created in many supervisors a fear complex that has often resulted in failure to inform employees truthfully regarding their performance.

"I am afraid to tell John how lousy he is for fear he will pass the word on to the grievance committeeman and then I will be on the carpet with management for failing to keep everyone happy." This statement by a foreman in one plant, while it appears ridiculous, is actually being repeated daily in effect by thousands of other supervisors who, confronted with the specter of "work stoppage," or, worse yet, "management displeasure," are afraid to tell their employees the truth.

Labor organizations have fostered this concept of deceitful supervision by encouraging incompetent employees in their criticism of supervisors who reprimand or use disciplinary measures. It is to be hoped that with the closed-shop or maintenance-of-membership clauses, which appear to be the trend of the day, the necessity for "encouraging the incompetent" will vanish. This, however, is doubtful, with the very success of most organized labor movements dependent upon the creation of dissension.

The failure of management rests chiefly in the silence of executives regarding their attitudes and intentions to their organization. The reluctance to pronounce policies, to set up standard practices, or to formulate ideals of procedure leaves to the intuition and inclination of subexecutives and individual workers policies and matters of direction which logically should be determined in advance.

Unfortunately, neither the labor organizations nor managements suffer the most from this lack of courage in dealing with personnel. The employee who continues to develop and practice bad work habits without the benefit of correction results in one of the most distressing cases in industrial life. If every supervisor could remember that one of the principal rights of an employee is to "know how he stands in the eyes of the boss," many of the deceitful practices would be automatically corrected.

Stressing to every supervisor his re-

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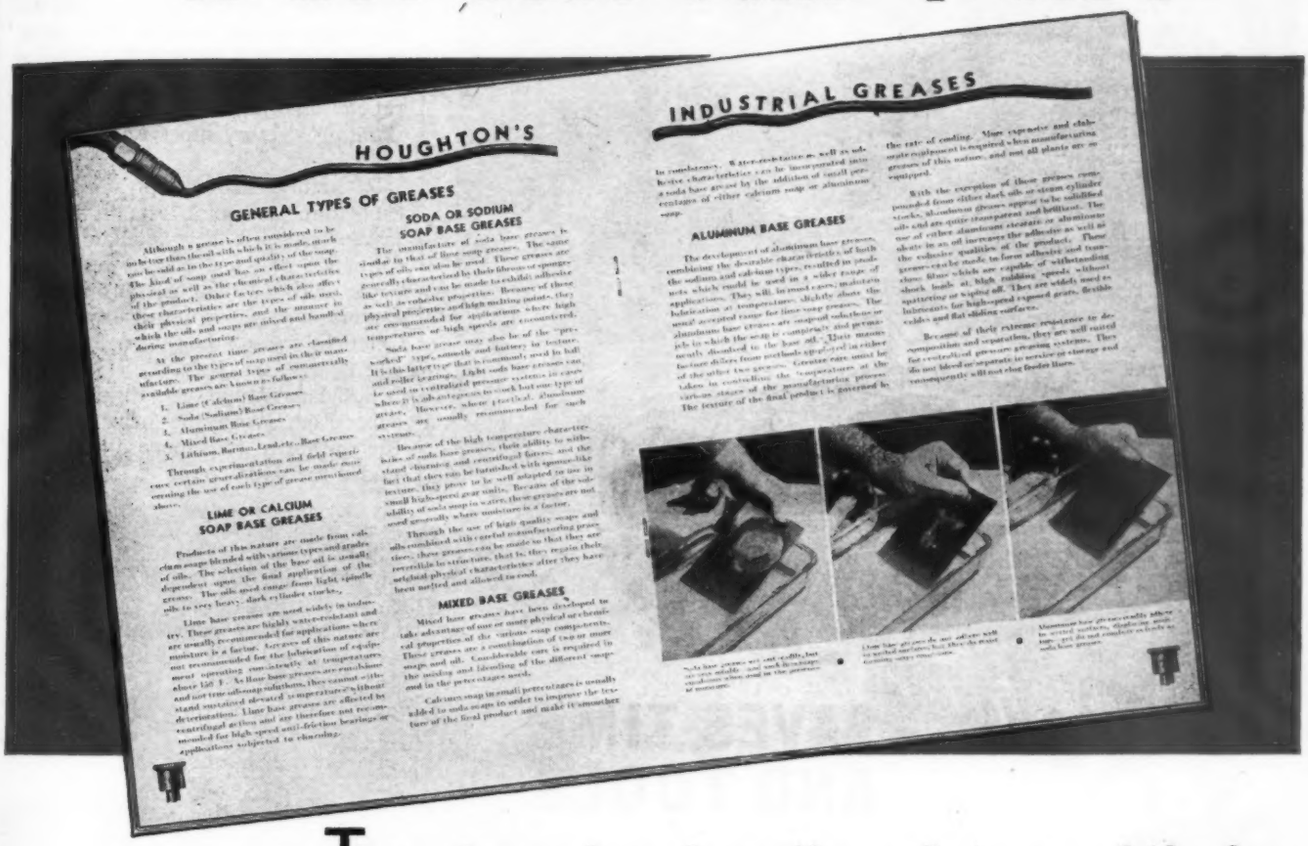

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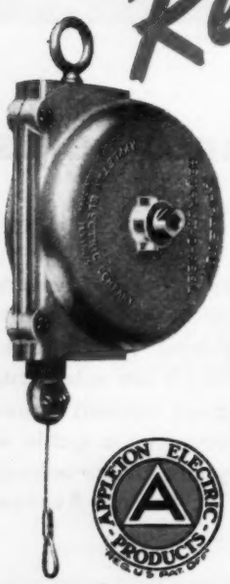

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sponsibility for the performance of the organization under direction, coupled with the "keep 'em happy" doctrine, quite often results in supervisors' covering up problem cases even when management installs elaborate merit rating or employee appraisal systems in an attempt to remedy this situation.

Although the problem appears to be an insurmountable obstacle, there are in reality many steps that can be taken to remedy this situation:

1. Management can assume the responsibility of formulating and announcing specific policies and intentions, which will prevent the "catch as catch can" disciplinary practices of supervisors and the distortion of understanding at every supervisory level.

2. Management and organized labor can assume as a joint responsibility the task of establishing a standard of performance or what constitutes a "fair day's work" which, if transmitted to the employees, will result in improved practices.

3. Management can return to the supervisors (with the help of labor) the authority to supervise employees under their direction.

4. Management through training can teach supervisors to base criticism on fact and to reprimand effectively.

5. Clean-cut grievance procedures can be established which will give the supervisor as well as the employee a chance to be heard, without the fear of becoming a scapegoat in the interest of industrial harmony.

The competitive personnel market during the war period has caused many companies to assign two workers to one man's job and to accept mediocre performance rather than run the risk of losing an employee. This in itself has caused many individuals to create undesirable work habits which may never be corrected.

Certainly they will not be corrected unless the leaders of management and organized labor recognize the importance of "honesty in supervision" and take steps to improve the situation which is general today in American industry.

•

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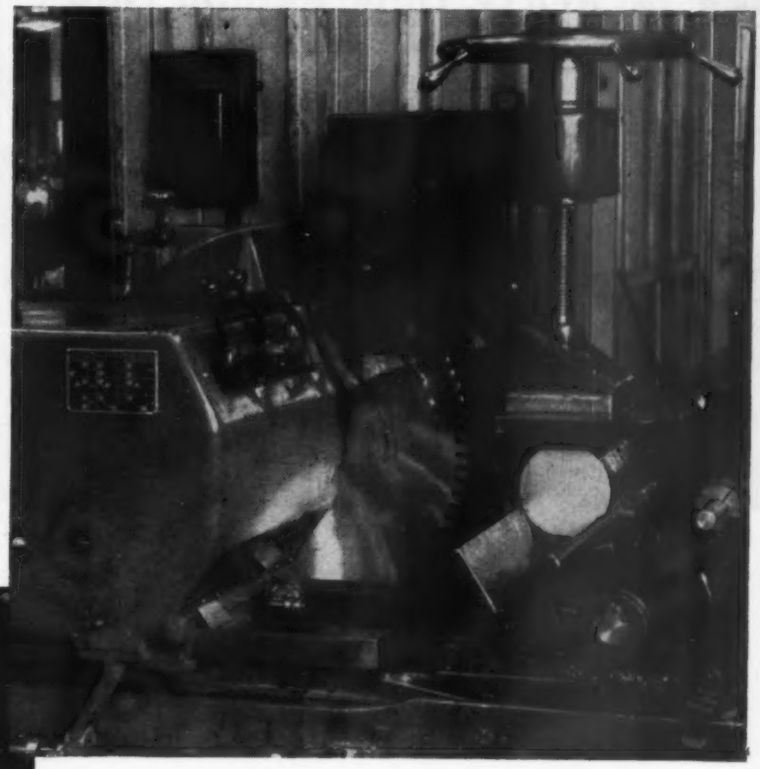

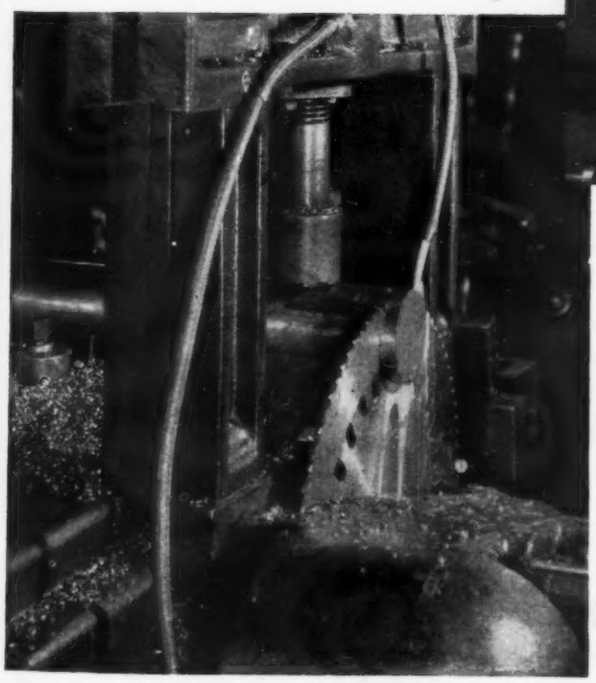

◂ SIMONDS Solid-Tooth Saws

These saws, as differentiated from inserted-tooth saws, are generally used over a range of work from mild steel and cold-rolled shafting, to annealed high speed and chrome nickel steels. They are made from Simonds own alloy steel for longest cutting life. Side clearance is assured by Simonds exclusive process of "radial grinding" . . . producing a saw of uniform rim thickness. These high-speed saws have set up many notable performance records like this: On phosphor bronze rods, 7½% tin and 1½″ thick, Simonds 12″ saws are cutting off sections in 8 seconds apiece.

*SIMONDS (rhymes with diamonds) is the name of the longest-experienced U. S. firm of saw-makers.

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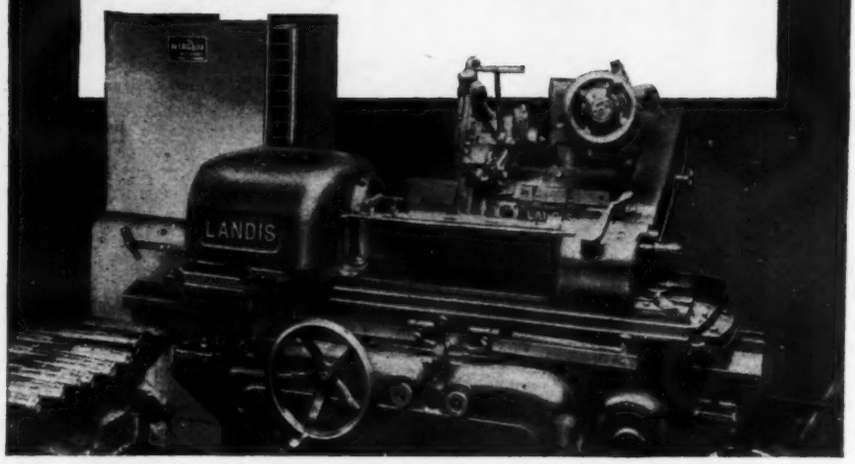
FITCHBURG, MASSACHUSETTS

WOULD MORE PRECISE TEMPERATURE CONTROL OF LIQUIDS OR GASES

IMPROVE YOUR PROCESS OR INCREASE YOUR PRODUCTION?



The **NIAGARA AERO HEAT EXCHANGER** holds the temperature of a liquid or gas within close limits. Many units have been installed because they provide a less expensive and less troublesome way of cooling fluids in an industrial process. But, after installation, users have discovered additional benefits of extra plant capacity, increased production and better quality production because the **NIAGARA AERO HEAT EXCHANGER** provided accuracy of temperature control.

Cooling of cutting oils, lubricants, quenching baths, engine jacket water; chemicals and intermediates; electronic sets; condensing gases, steam and refrigerants; controlled atmosphere processes; compressed air after-cooling—are processes in which these *extra* benefits are obtained.

For further information, write for Niagara Bulletins 90, 94 and 96, or ask about experience in your own field.

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of permanent relief, but a positive program for permanent prosperity."

NAM's detailed program for permanent prosperity, presented to the Senate Banking and Currency Committee along with testimony by Ira Mosher, the association's president, during hearings on the Murray Full Employment Bill, lists three end-objectives:

1. Jobs for all who want to work at wages which will provide an ever-widening area of security for workers.

2. An ever-increasing flow of goods and services to the public at more and more attractive prices.

3. A high and fairly distributed level of prosperity for all persons, all groups, and all sections of the nation.

The NAM document further asserts:

There are now present all the economic factors necessary for reaching these goals in the post-war period without sacrificing any of the political and economic freedoms provided by the federal constitution.

Aside from international catastrophes and great natural disasters, there are only three developments that can throw our economic system into a depression.

1. Mismanagement of the money and credit system, and the federal debt, in ways which convert prosperity into an inflationary boom.

2. Granting or perpetuating special privileges which hinder production or prevent the flow of goods and services to final consumers at reasonable prices.

3. Prevention of an adequate flow of private capital into productive, job-making activities.

To prevent mismanagement of the money and credit system, and of the public debt:

We must have a stable, clearly defined monetary unit. This can be accomplished only by having our monetary unit based upon, and defined in terms of . . . gold . . . and the gold content of our currency must not be subject to change by administrative decree.

We must have definite limits placed upon the credit expansion powers of our commercial banks.

We must make interest rates serve as a guide to the degree of strain to which our financial system is being subjected. We must restore the free functioning of interest rates and thereby permit free competitive forces to determine the distribution of the available supply of loanable funds.

We must make the banking system

FILES FOR DIES MUST BE RIGHT

Fitting tool-steel female punch die with a 10-inch Nicholson Round Smooth Cut File (illustrated)

RECONVERSION means busy days for the diemakers. And precision is one of the first rules in their highly specialized work.

Nicholson's study and manufacture of files for diemaking covers many years. We know the accuracy demanded — the cuts, shapes and *uniformity* required. Our service engineers are well qualified to recommend the right files for die jobs involving special problems. Nicholson co-operation is a helping hand that is always cordially extended to diemaking concerns and industrial managements in general.

A wide range of diemakers' files

Many Nicholson regular purpose files in the American pattern are suitable for finishing dies with liberal tolerances. Smooth and Second are the more commonly used cuts. For closer tolerances and intricate shapes, the slenderer, more pointed and finer cut regular types of Nicholson X.F. Swiss Pattern Files are available; and for small dies or extra-fine detail, Die Sinkers Files, Die Sinkers Rifflers and Round Handle Needle Files comprise a wide assortment of special shapes and sizes in the famous Nicholson X.F. Swiss Pattern line.

Contact your mill-supply house for currently or presently available types, shapes, sizes or sets of files.

FREE BOOK, "*FILE FILOSOPHY*"— 48 illustrated pages on kinds, use and care of files.

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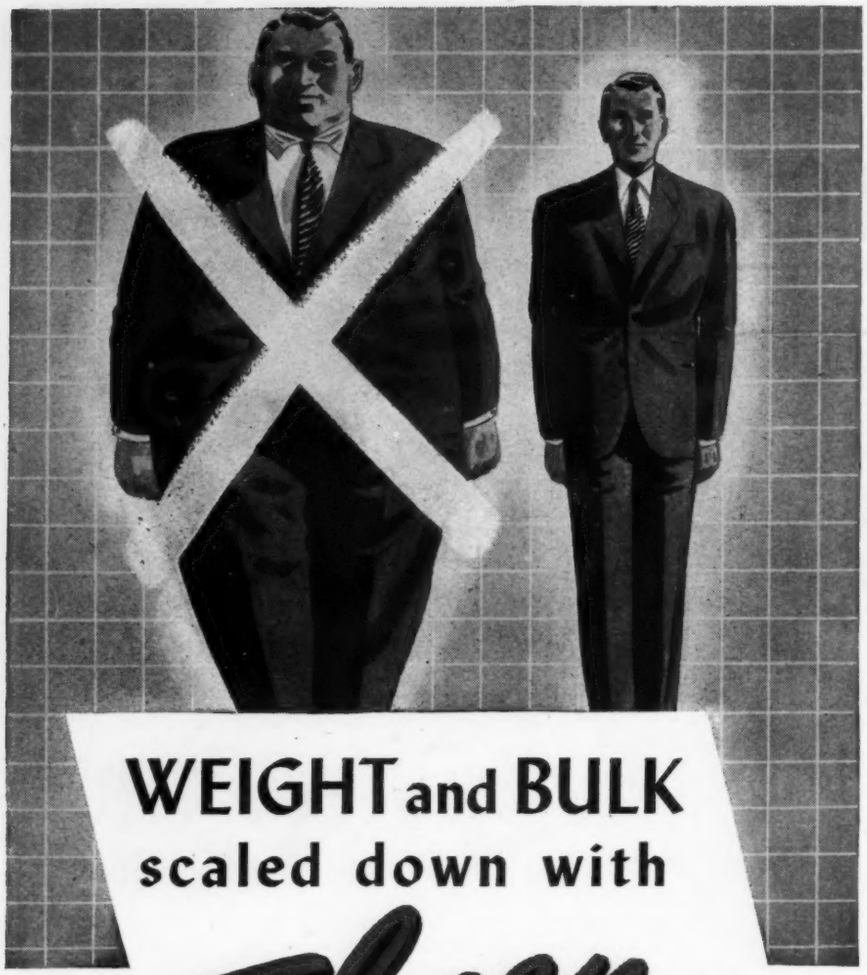
NICHOLSON U.S.A. MADE IN U. S. A.



WEIGHT and BULK
scaled down with
Fibreen

Not "human weight and bulk"—but, the kind of weight and bulk that manufacturers are up against when it comes to taking full advantage of a minimum freight car.

For example, a certain company was only getting about two-thirds of the box car load they were buying because of the way their product was wrapped and packaged.

Fibreen licked that one. With it, so compact a package was provided that where only *40* units were loaded into a car before, *60* were moved in . . . and still it went forward as a minimum car. Figure the saving, yourself.

In addition, considerable labor was saved and added protection to the contents was realized.

Maybe your wrapping and packaging problem lends itself to Fibreen. Get the facts on what this tough, dirt and waterproof paper has done for others and perhaps might do for you. Why not write for samples and complete information?

Sisal fibre reenforcement for strength—special asphalt for water-proofness—kraft paper for clean, easy handling—sealed by heat and pressure to produce Fibreen.

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serve as a hand-maiden of our economic system, not permit it to attempt to control the volume of business activity and employment. In practice this means the elimination of the idea that there is some volume of credit which is desirable regardless of existing underlying conditions, and then forcing this volume upon the economy.

We must get the public debt into the hands of those who will hold it as a permanent investment until the bonds mature and are paid off.

We recommend, therefore, that Congress create a special committee of experts to re-examine the whole money, banking, and public debt problem and report specifically on what legislative changes are needed and what policies must be followed by the banking authorities.

To keep the economic system free of special privileges:

We must have an attitude on the part of the public, and especially on the part of the government, which will deny special privileges to any section or any group.

Monopolistic conspiracies which reduce production, restrict markets, or keep prices above a fair competitive level must be prohibited. This is equally true whether they are in industry, finance, marketing, agriculture, or labor.

We recommend, therefore: (1) Vigorous and impartial enforcement of the anti-trust laws no matter how important economically or politically it is which thus gets hit; (2) legislation compelling the recording in the Patent Office of all patent agreements, both existing and future . . . excepting those covering non-exclusive licensing; (3) that the federal government seek agreements with other nations which will prevent the operation of all cartels which attempt to control production, distribution, or prices; (4) that Congress prohibit all closed labor unions, that is unions which refuse to admit qualified workers as members.

We recommend: (1) Gradual reduction of protective tariff duties . . . (2) that we continue to regard the tariff as a proper means for protecting industry, workers, and agriculture against "dumping" of foreign products; (3) that we use either the tariff or subsidies . . . for assuring an adequate production of items essential for military purposes.

Except when used for strictly military purposes, we recommend that Congress initiate a program for the systematic elimination of subsidies.

We urge that farm leaders provide the nation with a sound agricultural

THE BURNER that makes a new Boiler EASIER TO BUY

Thorough, accurate mixing of fuel and air . . . complete combustion . . . with Coppus-Dennis FANMIX

When planning new gas or oil fired boilers, you can count on investing less in boiler, stack and auxiliary equipment — if you select a Coppus-Dennis FANMIX Burner. Coppus equipment was used for instance in 93% of 191 petroleum refinery plants built for war use.

FANMIX Saves Combustion Space

FANMIX delivers to the furnace a homogeneous mixture of fuel and air, without blow-torch action. Combustion is rapid and complete — so smaller combustion space is needed than when the furnace must serve as mixing chamber as well — or ratings of present equipment can be increased.

FANMIX Creates Own Forced Draft

Less furnace draft is needed than with any other burner, because FANMIX creates its own forced draft, thus overcoming draft loss across the burner (at any operating range). Less stack is needed, and forced draft equipment can be eliminated entirely.

There are two FANMIX types—one to handle natural gas, the other a combination type to burn either gas or oil in entirety or gas and oil in any proportion. (No oil guns needed).

Coppus engineers FANMIX Burners for individual applications. Complete control over rate of combustion or "flame pattern" can be provided to meet the requirements of any installation. Coppus Engineering Corporation, 162 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

New Bulletin Will Help You When Installing New Equipment or Modernizing Old

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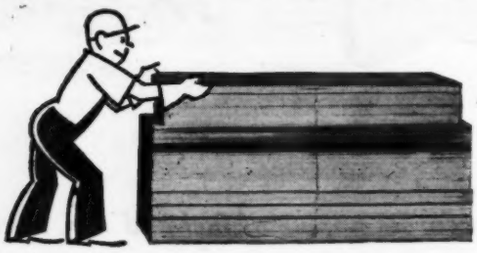
—A GOOD NAME TO REMEMBER WHEN YOU NEED STEEL SHEET AND WIRE PRODUCTS



STEEL SHEETS • Open hearth steel from Continental's furnaces is made into steel sheets with more than thirty different types of surface treatments, finishes and coatings. Continental specializes in the production of sheets with properties designed to best fit a definite class of duties. This special service in sheets fitted to manufacturers' needs helps cut production costs and make better products. Inquiries are invited.

WIRE AND WIRE PRODUCTS • Small enough to stitch like thread or large enough to serve as lever rods on the army's big earth movers . . . that's Continental wire, made of open hearth steel from Continental's own furnaces. Wire for manufacturers is available in standard and special shapes and many different finishes and coatings. Continental's finished wire products include Chain Link fence, widely used for the protection of industrial property.

*TRADEMARK REGISTERED U. S. PATENT OFFICE

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PRODUCERS OF STEEL SHEETS, including SUPERIOR Galvanized, COPPERIOR (copper-steel base) Galvanized, SUPERIOR Galvannealed, CHECKERCOAT Galvanized, Hot Rolled Annealed, Hot Rolled Pickled, Long Terne, and many styles of Galvanized Formed Roofing. **ALSO,** Manufacturer's Wire in many sizes, shapes, tempers and finishes, Continental Chain Link Fence, Nails, and other steel products.

program which will remove all special privileges for farming, as we have suggested the removal of all special privileges for business.

We recommend legislation to correct existing labor laws to provide for specific responsibilities and obligations for labor as well as management; to regulate union practices which restrict efficiency and maximum production or limit job opportunities; to prohibit the unionization of management members (foremen and higher levels of management); to require that labor unions, as well as management, abide by their collective bargaining contracts; and to protect individuals in their right to work.

We recommend that governmental agencies created by the war be abolished and government interference be kept to the bare minimum consistent with the public interest; that federal policy be modified to make collective bargaining a matter of mutual rights and obligations for both parties; that local and state mediation services be strengthened and made available to settle disputes which cannot be settled by the parties, by negotiation or through methods voluntarily agreed to by them; and that the federal conciliation service be strengthened on an impartial basis to facilitate adjustment of disputes extending over more than one state.

To assure an adequate flow of private capital into productive, job-making activities:

We must keep our economic system free from government manipulation of the value of the currency, irresponsible government spending in excess of revenues, actual or threatened government competition with private business, public statements by government spokesmen attacking the operation of private business, imposition of such extensive and complicated regulations that it is impossible for business to function efficiently, and from the issuing of orders by administrative agencies from which there can be no appeal before the courts.

We also recommend: (1) The income tax rate be held to a level which will not needlessly discourage individual endeavor; (2) it is desirable to bring the largest practical proportion of income earners under the individual income tax . . . to make them aware by direct taxation of the cost to them of their government; (3) eliminate burdensome excise taxes and all so-called indirect taxes except those necessary to provide a reasonably stable base for the tax system as a whole; (4) taxes on capital gains should ultimately be eliminated; (5) taxes on

Quiz Question: "What is Multilith?"
PRESIDENT:
"I use Multilith for confidential reports, operation records, and notices to stockholders."
PRODUCTION MANAGER:
"We use it on production orders and 'short lists.' Engineering uses it, too, for change notices."
SALES MANAGER:
"Multilith? Why that's the way I keep in contact with our field organization—with quota records, market analyses, price lists and bulletins."
OFFICE MANAGER:
"Multilith? Why that's used on our orders and billing—on shipping too!"
SECRETARY:
"Well, I use Multilith for form letters, instruction sheets, and inter-departmental communications. It saves us hours, every day."

EVERY one of these Multilith users is right—as far as his own experience goes. But these are only a few of the answers. Multilith duplicating is being used in countless ways, to provide businesses, large and small, with systems that save precious time, lighten work, and improve accuracy.

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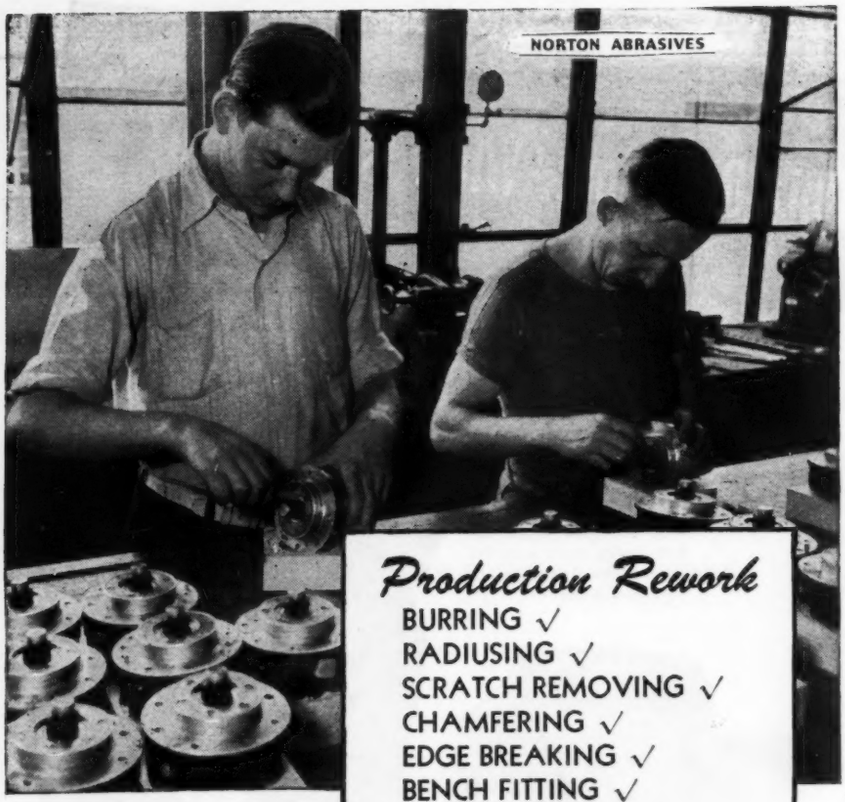

Production Rework
BURRING √
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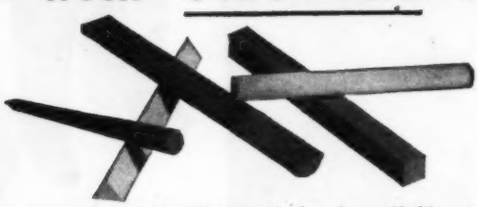
EDGE BREAKING √
BENCH FITTING √

Easier with OILSTONE FILES



OILSTONE files are abrasive files and they're *all* file, not just rows of cut teeth. But their main utility in production and rework finishing of machined parts lies in their ability to perform light, offhand stock removal operations after machining, but within the original tolerance limits.

Whether on revolving work or bench pieces, the hard, sharp abrasive crystals in oilstone files, shaped for conformity to work contours, quickly but delicately remove burrs and sharp edges, refine radii and bevels, or eliminate the binding of mated parts. India (Aluminum Oxide, oil filled) and Hard Arkansas (natural abrasive) Files offer Industry a complete size and shape range of over a hundred items with a finish spread from coarse, medium and fine India to the surgical fineness of Hard Arkansas.

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corporations should be set below the point of discouragement; (6) a fair method should be devised to eliminate double taxation which occurs by taxation of earnings of corporations and then taxation of individual income received from corporation dividends.

Further needed are a policy of rigid economy in all governmental activities, and a balanced federal budget on a basis of $15 billion per year, exclusive of debt retirement, when war expenditures are ended.

To be prepared to meet the ill effects of the program not being carried out to the full:

We recommend that if depression unemployment occurs, the federal government shall make such contributions to the states as necessary to provide needed relief; but temporary unemployment is a problem which can be better handled through state unemployment compensation funds.

•

Building Executives From "The Ground Up"

Looking to the future, and the need for thoroughly trained executives, is one company that is starting from "the ground up" to assure itself that its management will be in competent hands.

The company is the Coleman Company, Wichita, Kan., and the plan is to select college graduate engineers and give them a "post-graduate" course in practical factory operation.

Each year two to four men, graduates engineers of the Kansas State College and the University of Kansas, are chosen by company executives. The first year, these men work in the factory on actual production. This work is done in four production departments which have a diversity of operations, so that the graduates can obtain experience on all general types of factory production. In addition, during this first year, each graduate completes a course in modern business from an approved correspondence school. The cost of the course is taken care of by the company.

If the first year is satisfactory both to the student and to the company, the student starts the second year working in the company offices, and works in several different departments, including purchasing, scheduling, production engineering, industrial engineering, cost, and so forth. During the last three months he spends most of his time in the department where he has shown the greatest aptitude.

During the second year the gradu-

INSULATION "FALLING DOWN" ON THE JOB?

SIMPLY APPLY UNIBESTOS

it's simple to apply!

Here's an insulation that won't "fall down" on the job! Unibestos will not sag, gap, shatter or shakedown under the most severe vibration—always remains snug and firm against pipe, thus assuring maximum protection with a minimum of heat loss. Moreover, Unibestos efficiency is unaffected by moisture. Even when soaked, moisture can be steamed off without damaging Unibestos structural strength.

Unibestos is available in half-section form up to 30" pipe diameter, and in quarter-section form from 32" to 60"—in thicknesses from ¾" to 5". Single layer construction is available for service up to 1200°.

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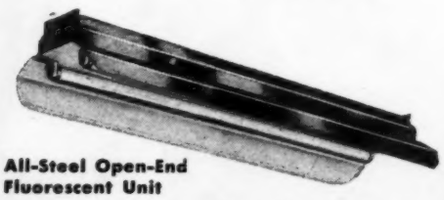
Skilled Lighting!

Helps make Skilled Hands!

Skilled work thrives on *Skilled Lighting.* Down goes the costly record of errors often due as much to blinding glare as uncertain shadow. Up goes production, both in quality and quantity, thanks to evenly distributed, shadow-free *Light* – the kind that Wheeler engineering has made famous throughout industry!

Better work and reduced costs are practically automatic when you install Wheeler Reflectors – the product of 64 years of specialized lighting experience. For they are engineered to get maximum illumination from *standard lamps.* And because of their efficient design, heavy duty materials, and high grade vitreous enameling, they stand up longer, require less maintenance.

Learn how you can lighten the load on your workers – and your operating costs. Send for catalogs showing complete line of incandescent and fluorescent lighting fixtures. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Also New York. Representatives in principal cities.



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Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuous runs.

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Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

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ate has two additional tasks to fulfill—he must read and make a written report once a month on an article in some important trade magazine, and he must enroll in a public speaking course and complete it satisfactorily.

At the end of the second year, the graduate is moved into a regular job with the company, and from there on is on his own.

•

Anticipation of Business in General

Business does not regard reconversion as a return to pre-war days, but rather as an advance into new territory. This is the conclusion drawn from the replies of key executives in seven fields—production, personnel, finance, office management, marketing, insurance, and packaging—to questions asked by the American Management Association before the preparation of its annual report.

"There is a deep conviction," the report states, "that management must become more sensitive to changing social concepts and ready its thinking and its operation to facilitate rapid adjustment to these changes. Agreement is universal that the overwhelmingly great problem of our times will be that of maintaining continuously a high level of employment, and that to that end the major contribution must come not from government but from business.

"Production managers are aware that although emphasis is shifting from production to sales, their function will experience loss of drama but not of importance, for intensified competition will emphasize the need for cost reduction if the company is to maintain its competitive position. . . . It will require all the energy, understanding, and determination that management can exercise to achieve a return to true cost consciousness. Management will recognize that although production no longer occupies the glamorous role it did when the demands of war were most urgent, the need for the development of cost reduction measures in the plant will loom more importantly than ever. . . Exacting budgetary controls must be reestablished, and some financial executives believe that it may even be desirable to introduce incentive measures to assure successful performance of these controls."

In line with this is the view taken by most executives in the personnel field. "They believe," the report continues, "that the competitive situation and

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JOHNSON'S
WAX-FORTIFIED
Interior Finish
gives your walls these 4 PLUS features:
Rich, lustrous beauty that only wax-fortification makes possible.
Lengthened decorating cycle because of remarkable durability. Stays clean longer, resists stains, mars and scratches.
Easier cleaning when finally necessary, because of the wax. Film retains its gloss—resists caustic cleaners.
High light reflection longer—better light diffusion. Satin-smooth finish—no harsh glare.
Coming your way! Though not available today, this wax-fortified finish will be supplied just as soon as war restrictions on certain materials are lifted. Now is the time to get all the facts!

in this patented maintenance finish!

Wax impregnation—that's the difference—and that's why Johnson's Wax-Fortified Interior Finish gives you these important advantages! Wax-Fortified has wax *all through* the film. Its rich wax lustre lasts as long as the finish remains—doesn't dull when washed or cleaned, and is easier to clean when necessary. Light reflection values—high at the start—remain high, yet don't cause glare, because light rays are diffused.

Higher maintenance efficiency—lower maintenance costs

Wax-Fortified is a superior finish—a different finish that gives greater beauty and extra protection. It is made in white and a variety of colors that have broad coverage and great hiding power.

Refinishing is easy

When refinishing is finally necessary, the wax in Wax-Fortified does not retard adhesion, and no special cleaning is required. You can recoat with Johnson's Wax-Fortified, or with ordinary paint.

Bakeries, food plants, dairies, factories, office buildings, department stores, schools and hospitals will find Wax-Fortified a boon to solving their painting problems. It will give them a better finish and greatly simplify maintenance.

For full details, mail the coupon today!

★ *Now! Buy EXTRA War Bonds—and hold what you have!* ★

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JOHNSON'S WAX

A name everyone knows

S. C. JOHNSON & SON, Inc., Racine, Wisconsin
S. C. Johnson & Son, Ltd., Brantford, Canada

S. C. Johnson & Son, Inc., Dept. **FM-95**
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Gentlemen: Yes, I'm interested in what "Wax-Fortified" will do for my walls. Please send the "What's Ahead in Paints" brochure.

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for MAINTENANCE PAINTING

Choose Eclipse Spray Equipment for maintenance painting because:

Eclipse Low-Pressure operation gives maximum coverage per gallon – eliminates objectionable offspray, or fumes – assures a clean, fast job . . . and uses minimum pressure and volume of air.

Ask for an Eclipse Spray Engineer to call and discuss your maintenance painting problems. There is no obligation, of course.

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its concomitant need for cost reduction must be met not by greater pressure on employees but by the wise building of sound employer-employee relations. They believe that it is vital to improve two-way communication between management and labor. They believe that unions must join management to find a common base for discussing standards of performance. They believe that sound training, covering the entire field of job responsibilities and human relations, must be extended and improved." Few personnel men expect that a return to peacetime economy will mark the end of collective bargaining; and some foresee its development on an industry-wide basis.

In the marketing field, the report indicates, companies are faced with the problem of "winning back the good will of customers who feel they having been dealt with unjustly during the years of shortages, while concurrently seeking sound relationships with new customers—and they will have to do all this notwithstanding the fact that in many fields the continuation of voluntary rationing by the producer will be necessary."

The office manager foresees a period in which his duties will tend increasingly to parallel those of the production executive, with planning, layout, production facilities, and methods assuming ever-growing importance.

Relatively few plants in the packaging field will face a reconversion problem, according to the report. "Manufacturing lines that were used the production of blood plasma cans will run soup and coffee cans almost without change. Wooden box factories that produced boxes for small arms ammunition will start making fruit boxes with few, if any, changes in equipment, machinery, or methods."

•

Government Should Run War Plants, CIO Believes

The Little Steel formula is as "dead as a doornail," in the opinion of Philip Murray, president of the United Steel Workers—CIO, expressed at a mass meeting recently, when he stated also that a drive for an immediate wage increase for the steel industry will be launched on September 11.

Murray said that he is not favoring a return to relief or the Works Progress Administration. He is rather of the opinion that every able-bodied citizen who is willing and able to work should be given an opportunity to "engage in a profitable occupation at high wages." He believes that Congress has been

if you're
moving materials 200 feet or more...

DO IT QUICKER, CHEAPER WITH THE...

FORK TRUCK "TRACKLESS TRAIN" SYSTEM

Industry can well profit from close study of the improvements in materials handling technique developed by the supply divisions of our armed forces. Of particular interest is the wide use of the Fork Truck—"Trackless Train" System for handling materials when distances exceed 200 ft.

In the system the fork truck (a handling and stacking machine) is used for loading trailers. Loaded trailers are made up into trains and hauled away by a tractor. "The Trackless Train" has no fixed path and may travel anywhere that necessity dictates. At destination, the fork truck removes and stacks the pallet loads to ceiling heights.

A few of the many advantages of the system are:

(1) Equipment works continuously—"dead heading" reduced to the minimum.

(2) Handles larger loads—one trailer train is equivalent to 5 to 10 truck loads.

(3) Less manpower required.

(4) Lower investment in equipment for handling comparable volume.

(5) Lower power consumption in transporting; only the tractor consumes power.

These handling advantages are also available to you. For the complete story ask to have a Mercury Engineer call—or write for Bulletin 7-11.

THE MERCURY MANUFACTURING COMPANY
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MERCURY

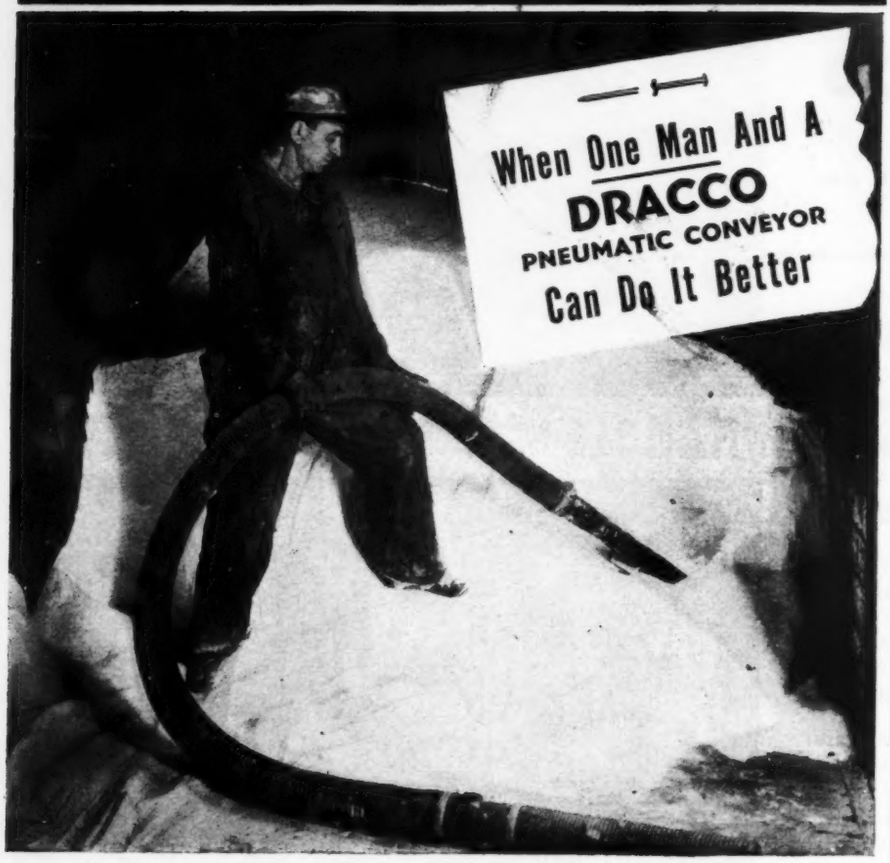
TRACTORS · TRAILERS · LIFT TRUCKS

HANDLE Mercury "Jeep" fork truck pallet loading type "A-310" Mercury castor steer trailers.

HAUL A train of loaded trailers is coupled to the Mercury "Tug" electric tractor and hauled to destination. "The Trackless Train" has no fixed path and may travel anywhere necessity dictates.

STACK At destination the tractor is uncoupled and sent on its way. The "Jeep" removes the pallet loads from the trailers and stacks them to ceiling heights.

Why Use SEVERAL Men To Handle Materials



There is the most efficient way of moving chemicals, grains and granular materials. Down through the years many have found that DRACCO Pneumatic Conveyors will do this operation at the MINIMUM expense and much better than by obsolete methods. One of the outstanding advantages is the saving in labor. In most installations ONE man and a DRACCO Pneumatic Conveyor does the work formerly done by SEVERAL men. DRACCO Engineers have 30 years experience reducing handling costs — why not consult them? They have solved handling problems for many.

For Further Information Write

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PNEUMATIC CONVEYORS • METAL FABRICATION

"derelict in its duty," because it has hesitated to pass the unemployment relief measure recommended by the President. He said that "politicians . . . are either for full employment or against it, and it is for labor to find out who is for full employment and who is against it."

He believes also that government should continue to operate war plants built at government expense. "It was the given responsibility of certain businesses to continue the operation of those plants for which our government expended $15,000,000 in the course of the war, and if private enterprise is unwilling to operate those plants then it is the responsibility of the American government to see to it that these plants are operated."

Labor should interest itself in the speedy enactment of the proposed bill to improve the present system of old age pensions, Murray asserts. He also urges fair employment practice legislation. His reasons for a general wage rise he listed as the rise in the cost of living, reduction of the work week to 40 hours with consequent loss of income to workers, and legislation protecting industry's profits, including the "carry-back provision" dealing with loss of profits after the war, and a rebate on general taxes to employers.

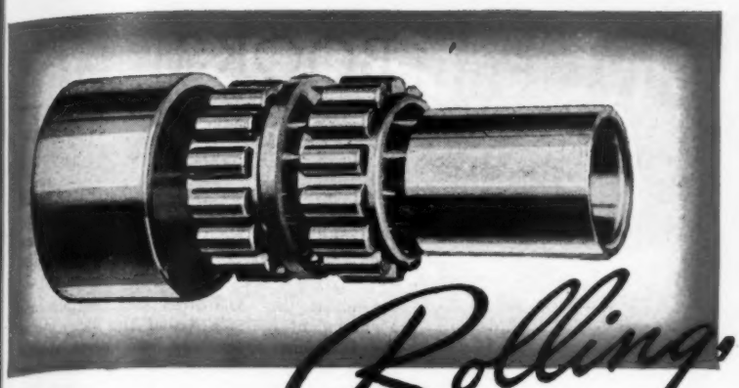
•

A Bonus Plan for Indirect Labor

An incentive bonus plan for non-productive workers which is tied in with the monthly dollar volume of sales has been approved by the National War Labor Board, with certain specified controls.

The plan, submitted by the Continental Motors Company, Muskegon, Mich., and the United Automobile Workers, CIO, covers 2500 non-production, hourly rated employees, and 215 supervisory and service employees.

As set up, the monthly allowable (or standard) hours which the non-productive workers should work is determined by multiplying the monthly net sales by 0.045 and adding 30,500 hours. The fraction 0.045 represents the standard number of hours worked per dollar of sales, and 30,500 represents the number of hours required per month for non-productive work. The efficiency of the non-productive group is calculated by dividing the actual number of hours worked by this group into the monthly standard hours. The bonus is paid on the basis of the percentage efficiency above 100 percent.



Rolling, Rolling, under the speeding train

Today, anti-friction bearings roll 'round and 'round on the journals of many railroad cars and diesel locomotives—speeding travel, smoothing rides and extending periods of trouble-free operation.

Carrying tons of weight at high speed, however, means wear, especially on the inner and outer races shown above, unless they are unusually and uniformly hard.

And UNIFORMLY hard they are—because they are made of electric furnace steel—a major part of which comes from Republic furnaces.

In electric furnace melting, steels can be "targeted" to hit narrow product and processing specifications with an unvarying exactness possible in no other method of steel-making. Thus response to hardening treatment and the resulting degree of hardness can be accurately predetermined, along with physical, chemical and mechanical properties. And such uniformity enables manufacturers to improve product quality and at the same time realize full benefits from mass production methods.

Republic Electric Furnace Steels are as CLEAN and SOUND as the most expert furnace practice can make them. They are free from small imperfections which, because they remain hidden until final inspection, cause the loss of many costly man- and machine-hours.

No matter what you make or intend to make after the war, there undoubtedly are parts which can be made better and cheaper with Republic Electric Furnace Steels. And Republic—world's leader in this field of steel-making—is ready NOW to help you use them to best advantage.

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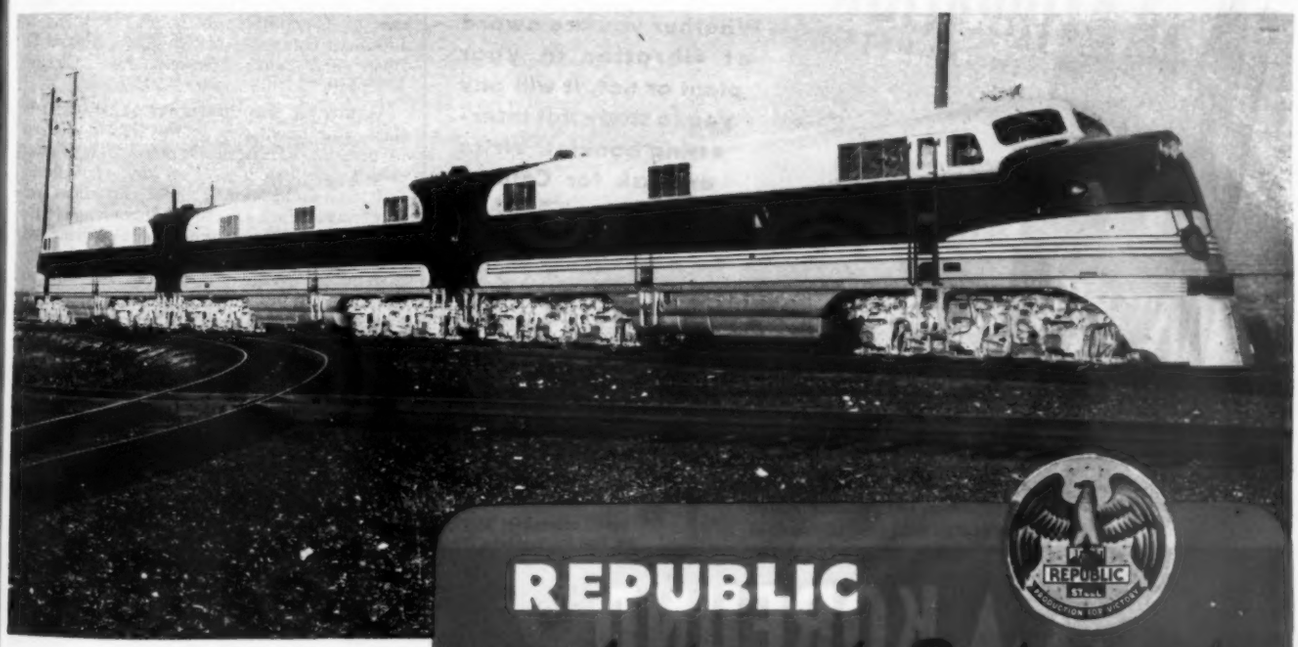

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"QUALITY" steels . . . alloy . . . stainless

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THE ANSWERS
TO WHERE
AND WHY
YOU SHOULD
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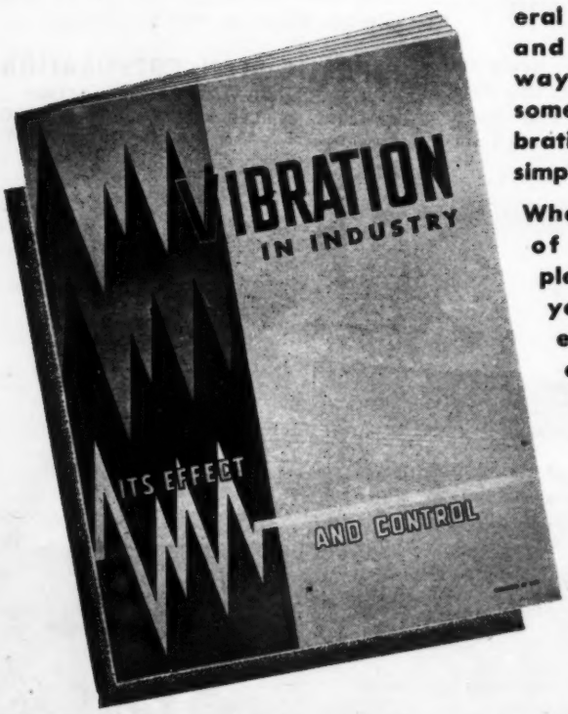
CONTROL

Send for this new 12-page booklet explaining the why and how of vibration control. Vibration can result from several sources in any plant and be costly in many ways. Here are shown some typical causes of vibration together with the simple method of control.

Whether you are aware of vibration in your plant or not, it will pay you to study this interesting booklet. Write and ask for Catalog SP-650.



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BOOKS

PRACTICAL SUPERVISION

Palmer J. Kalsem, Engineering Educational Department, The Glenn L. Martin Co. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 186 pages. Cartoon drawings, index. $2.

One of the "Industrial Organization and Management Series." Using the language of the front-line supervisor, book gives specific things to do in dealing with his immediate problems. Is intended as a guide to show him how to lead his men in order to get the best results in satisfying both their requirements and those of his superiors. In 21 chapters, including a list of books for supervisors, and plus an appendix that shows the results of an employee opinion poll.

BUSINESS ORGANIZATION AND PRACTICE

Edwin M. Robinson, A.B., M.B.A., Professor of Management, Boston University College of Business Administration. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 557 pages. Photographs, forms. $2.75.

Explains what business is, how it is owned, and how organized for work. In 19 chapters, including "How Business Is Organized for Work"; "Organization for Finance"; "Organization of Physical Facilities"; "Organization of Personnel"; "Organization for Administration and Control"; "Organization for Purchasing"; "Organization for Traffic Management"; "Organization for Production (Manufacturing)"; "Organization of the Individual."

HUMAN RELATIONS IN INDUSTRY

Burleigh B. Gardner, Ph.D., Assistant Professor of Industrial Relations, Executive Secretary of Committee on Human Relations in Industry, University of Chicago. Richard D. Irwin, 332 South Michigan Ave., Chicago. 307 pages. Figures, index. $3.75.

Written to help executives and students in their basic orientation to the human elements in industry. Thirteen chapters: "The Factory as a Social System"; "The Line of Authority and Communication"; "The Functions and Problems at Each Level"; "Segmentation of the Structure"; "The Union: Its Functions and Place in the Structure"; "Wages and Wage Systems"; "Wage Incentives and Restriction of Output"; "The Individual in the Structure"; "The Industrial Relations Organization"; "Personnel Counseling"; "Minority Groups in Industry"; "Problems of Cooperation"; "Understanding Social Structure."

THE ELECTROLYTIC CAPACITOR

Alexander M. Georgiev. Murray Hill Books, Inc., 232 Madison Ave., New York 16. 191 pages. Photographs, figures, drawings. $3.

Describes the design, construction, manufacture, function, and testing of dry and wet electrolytic capacitors, explains the operating characteristics of the various types, and indicates both their useful applications and their limitations.

CONTROLLERS FOR ELECTRIC MOTORS

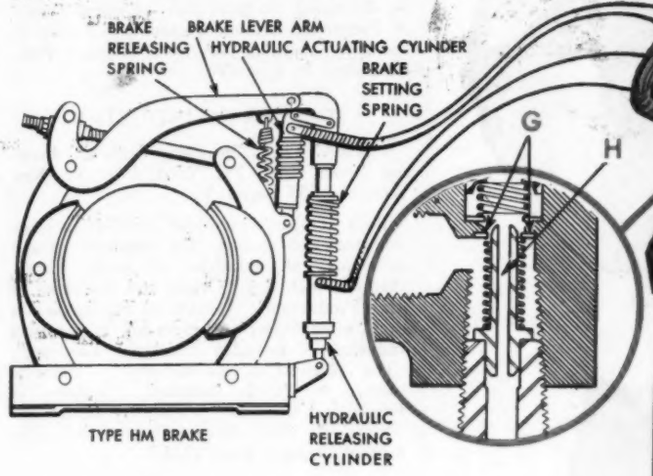
Henry Duvall James, B.S., M. E., Consulting Engineer, and Louis Edwin Markle, B.S., Design Engineer. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 324 pages. Photographs, figures, index. $3.50.

Subtitled "A Treatise on the Modern Indus-

Only the Wagner type HM HYDRAULIC CRANE-BRIDGE BRAKE

provides ALL THREE requirements of a PERFECT BRAKING SYSTEM

1. **FOOT-CONTROLLED HYDRAULIC BRAKE** for service stops
2. **AUTOMATIC SPRING-SET BRAKE** for parking
3. **AUTOMATIC CUSHIONED EMERGENCY STOPS** when power fails or crane runs beyond safe limits



IT'S one thing for a crane-bridge brake to set automatically when the power fails—but it is another matter for the brake to set *smoothly* and bring the load to a *cushioned* stop! That's how the Wagner type HM Hydraulic Crane-Bridge Brake stops the bridge and its load: smoothly and safely. There's no jerk, no strain on the machinery, no undue swinging of the suspended load.

A tiny valve in the HM brake control unit is the secret to the cushioned stops. As the cut-away photograph at the right reveals, the hydraulic fluid in the parking-brake cylinder escapes thru a restricted opening, so that the full force of the spring is released at a rate accurately predetermined to provide a smooth, cushioned stop. . .

The control unit, of which the "Cushion-Stop Valve" is a part, consists of a transformer (A) and a selenium rectifier cell (B) that converts alternating current to 12 volts direct current (the direct-current unit resistors are substituted to reduce the direct-current voltage), a magnetic valve which traps hydraulic fluid in the spring-set brake cylinder, the "cushioned-stop valve", and a pressure switch. The entire unit is simple in design, with very little wear factor and hence very little maintenance involved. The short description at the right will help you to understand how the brake control unit works.

The brake control unit is but one of many features making the Wagner type HM Hydraulic Brake the ideal brake for crane bridges. Among other features are: (1) pushbutton control in crane cab enables operator to set brake as desired, (2) signal light indicates when parking brake is released, (3) brake control can be interlocked with motor pilot-circuit to insure release of brake before starting motor, (4) brake can be set at any time during cycle of crane operation by use of limit switches, (5) can be applied to almost any type of industrial crane equipment.

For a complete discussion of the Wagner type HM Hydraulic Crane-Bridge Brake, read Bulletin IU-186, which we'll gladly send you on request.

MAGNET (C) controlling plunger (D) is energized when switch (J) closes line circuit (L).

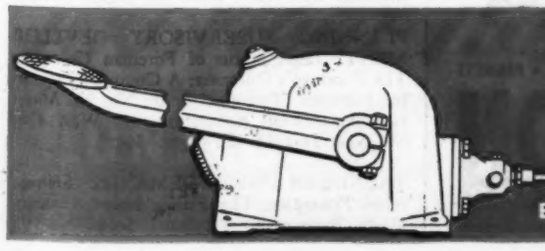
PLUNGER (D) closes escape port in sealing cup (F). Fluid entering port (E) passes readily through sealing cup (F), but cannot return while magnet is energized.

METERING DISC (G) meters the escape of fluid when magnet is de-energized—thus releasing the spring-set brake at a predetermined rate to effect a smooth, cushioned stop.

SWITCH (J) is operated by plunger (I) which is actuated by fluid entering through tube (H). This tube directs the flow of fluid to assure a full release of the spring-set brake before line circuit is closed and magnet is energized.

PILOT CIRCUIT (K) is completed when line circuit is closed, lighting pilot light in control cab—notifying operator that spring-set brake is released and bridge brake is ready to operate.

145-9



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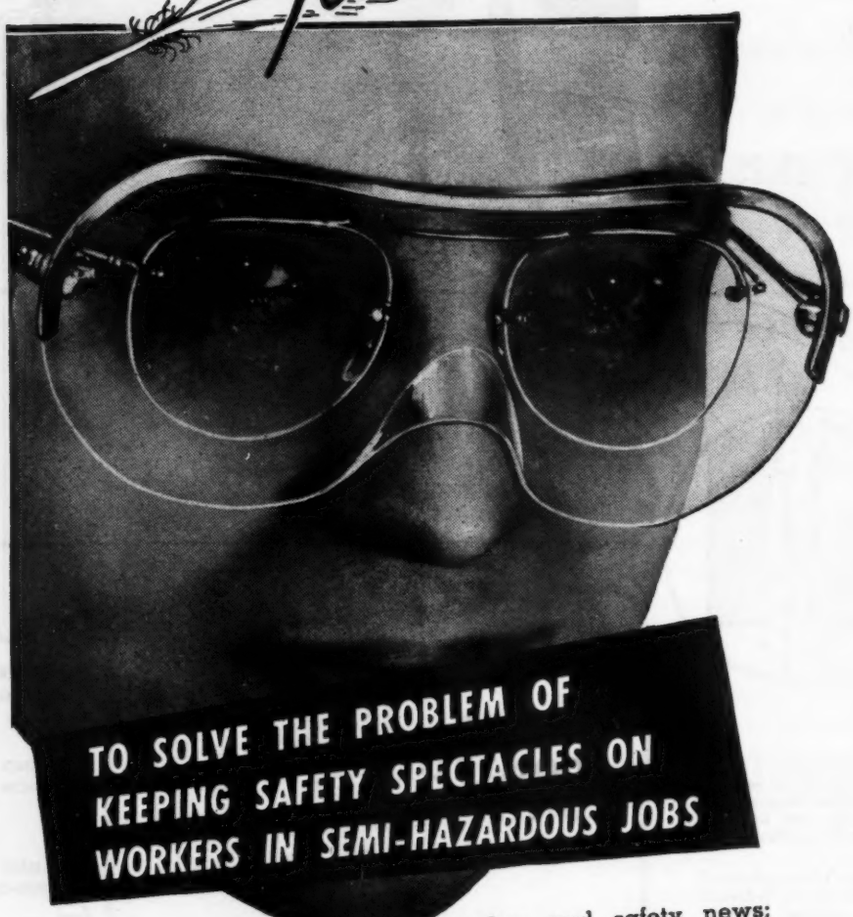
FeatherSpec



TO SOLVE THE PROBLEM OF KEEPING SAFETY SPECTACLES ON WORKERS IN SEMI-HAZARDOUS JOBS

• FeatherSpec makes real safety news; weighs less than an ounce; much lighter than other types. Large one-piece plastic lens; can be replaced in ten seconds; held firmly in "suspension-lock" frame; in clear or Willson *Tru-Hue*★ green. FeatherSpec means real economy; costs less; can be worn over regular glasses; saves cost of special prescription spectacles. FeatherSpec is convenient to carry; slips into shirt pockets. FeatherSpec provides new convenience; new comfort; so workers will wear it all day long; for light grinding, spot welding, woodworking and so forth.

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trial Controller with Typical Applications to the Industries." A manual on all types of commercial motor controls, describing their construction, performance, and operation, and giving pointers on maintenance, for operating men, application engineers, and purchasers of controls.

SAMPLING STATISTICS AND APPLICATIONS

James G. Smith and Acheson J. Duncan, Department of Economics and Social Institutions, Princeton University. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 498 pages. Figures, tables, index. $4.

Intended for the second course in statistics. After reviewing basic concepts and definitions, the authors discuss the general theory of frequency curves and the theory of random sampling. Sampling distributions are derived and their applications to a variety of problems are illustrated. In three parts—General Theory of Frequency Curves; Elementary Theory of Random Sampling; Advanced Sampling Problems—and an appendix.

SECRETS OF INDUSTRY

Lewis C. Ord, Consulting Engineer. Emerson Books, Inc., 251 West 19th St., New York 11. 255 pages. $3.

Book compares industrial methods in many countries and analyzes the requirements and techniques of industrial efficiency. Sixteen chapters, including "Origin and Principles of Mass Production"; "Growth of Big Business in the United States"; "Leadership in American Industry"; "American Industrial Efficiency"; "The Trend to Bureaucracy"; "Historical Sketch of British Industry"; "Industry in France and Germany"; "Industry Under Dictatorships"; "Industry in Democracies"; "Industrial Changes Since 1938."

ELEMENTARY ELECTRIC-CIRCUIT THEORY

Richard H. Frazier, Associate Professor of Electrical Engineering, Massachusetts Institute of Technology. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 434 pages. Drawings, figures, index. $4.

An elementary exposition of electric-circuit theory necessary for all students of electrical engineering. Includes the study of the steady and transient states in d.c. and a.c. circuits having linear parameters. Provides a basis for the more advanced study of power system networks, communications networks, electron tube circuits, and associated apparatus. Practice problems are provided.

BOOKLETS

PUMP ENGINEERING DATA. Economy Pumps, Inc., Hamilton, Ohio. 416 pages. Photographs, drawings, index. No charge to engineers and others writing on business letterheads. Otherwise, $2.

HOW TO GET THE JOB YOU WANT. John W. Herdegen. Essential Books, 270 Madison Ave., New York. 92 pages. $1.

PLANNING SUPERVISORY DEVELOPMENT. Legal Status of Foreman Unionism; The Foreman's Dilemma; A Company Program for Foremen. Personnel Series No. 96. American Management Association, 330 West 42nd St., New York 18. 28 pages. 50c.

TRENDS IN UNION DEMANDS. Management Principles; The Fringe Issues; Industry-Wide Bargaining. Personnel Series No. 95.

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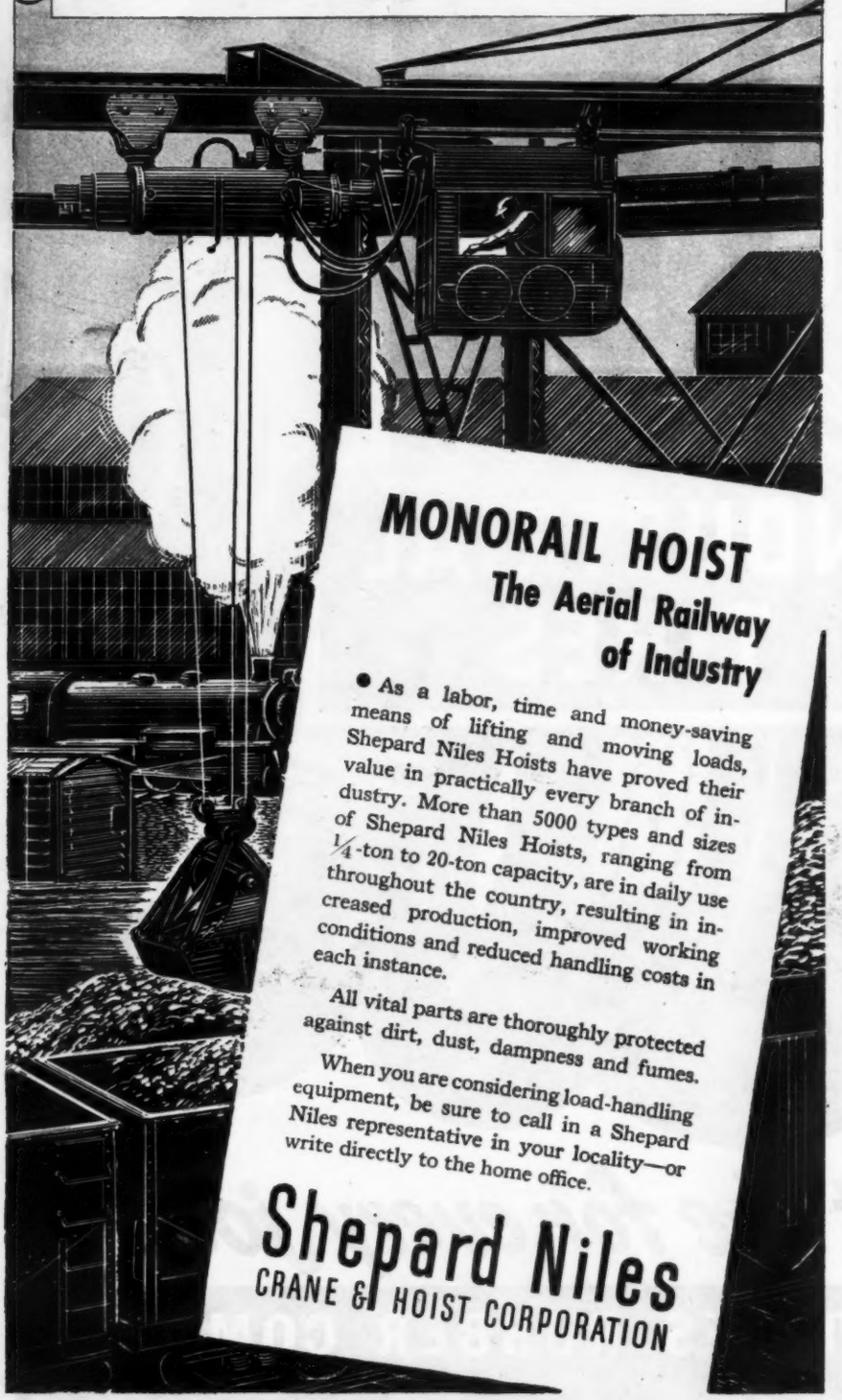

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The Aerial Railway of Industry

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All vital parts are thoroughly protected against dirt, dust, dampness and fumes.

When you are considering load-handling equipment, be sure to call in a Shepard Niles representative in your locality—or write directly to the home office.

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American Management Association, 330 West 42nd St., New York. 24 pages. 50c.

SOUNDINGS IN THE LITERATURE OF MANAGEMENT. Fifty Books the Educated Practitioner Should Know. Harry Arthur Hopf. Publication No. 6. Hopf Institute of Management, Inc., Ossining, N. Y. 28 pages. 75c for one copy, less if more than ten are ordered.

MEETING PERSONNEL REQUIREMENTS OF RECONVERSION. Conditions Required for Full Employment; War's Impact on Labor Relations; Recent Developments in Personnel Work; Personnel Adjustments During Reconversion; Relaxation of Government Controls. Personnel Series No. 94. American Management Association, 330 West 42nd St., New York 18. 71 pages. $1.

•

ON THE CALENDAR

SEPTEMBER

18–19, American Management Association, Packaging Conference, Hotel New Yorker, New York. Henry J. Howlett, Secretary, 330 West 42nd St., New York.

21, Association of Consulting Management Engineers, Inc., Program Meeting, University Club, Chicago. Nathaniel W. Barnes, Executive Secretary, 347 Madison Ave., New York.

OCTOBER

9–10, American Management Association, General Management Meeting, Hotel Pennsylvania, New York. Henry J. Howlett, Secretary, 330 West 42nd St., New York.

30–31, American Management Association, Production Conference, Palmer House, Chicago. Henry J. Howlett, Secretary, 330 West 42nd St., New York.

NOVEMBER

14–15, American Management Association, Office Management Conference, Hotel Pennsylvania, New York. Saul Poliak, 330 West 42nd St., New York.

COURSE IN ENVIRONMENTAL CONTROLS

OCTOBER

2–4, Inservice Training Course in Environmental Controls for Industrial Processes. H. E. Miller, Resident Lecturer in Public Health Engineering, School of Public Health, University of Michigan, Ann Arbor, Mich.

Meetings Canceled

SEPTEMBER

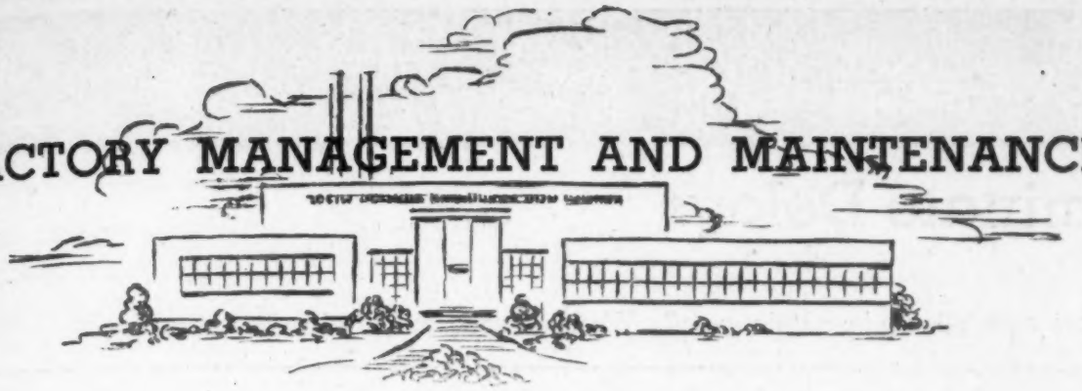
Association of Iron & Steel Engineers, Annual Technical Conference, Pittsburgh. Brent Wiley, Managing Director, Empire Building, Pittsburgh.

OCTOBER

American Institute of Accountants, Annual Meeting, scheduled for October 22. John L. Carey, Secretary, 13 East 41st St., New York 17.

American Society for Metals, National Metal Congress and Exposition, Cleveland. W. H. Eisenman, Secretary, 7301 Euclid Ave., Cleveland 3.

FACTORY MANAGEMENT AND MAINTENANCE



RECONVERSION GUIDE

The time for reconversion to the manufacture of peacetime products is here. From now on, industry's main objective will be low-cost production. It can be attained only by making fullest use of efficient equipment and the best techniques of plant operation. To learn exactly where you own plant stands, ask yourself the questions in this guide. To assist in quick reconversion, decide which items you must do something about immediately

ELIMINATE DELAYS • REDUCE OVERHEAD EXPENSE

IMPROVE PERFORMANCE OF PRODUCTION EQUIPMENT

STUDY AUXILIARY EQUIPMENT AND BUILDINGS

SURVEY WORKING CONDITIONS·PREPARE FOR EXPANSION

SET UP PREVENTIVE MAINTENANCE

FACTORY MANAGEMENT AND MAINTENANCE, SEPTEMBER, 1945 • In Two Parts, Part Two

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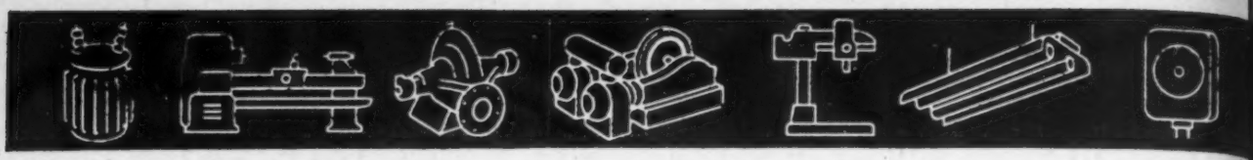


Eliminate Delays

1. Does work pile up in certain spots? Where is work likely to be sidetracked? ☐
2. Is work kept on the move? Is steady flow of production maintained? ☐
3. Have production processes been analyzed with a view to eliminating, combining, or changing operations? ☐
4. What part of productive workers' time is taken up with handling? ☐
5. How many manual handling operations can be eliminated by the use of mechanical handling equipment? ☐
6. Has the distance each part travels from raw stock to finished product been measured? Can this distance be reduced? ☐
7. Can time be saved by laying out all operations in straight-line production instead of routing work through functional departments? ☐
8. Is there any backtracking? Can it be eliminated? ☐
9. Will regrouping of machines or operations reduce the distance traveled by parts or subassemblies? ☐
10. Has every manual operation been studied to see whether it might be handled economically by some type of mechanical equipment? ☐
11. Has the possibility of mechanical loading or unloading been studied? ☐
12. Does work arrive at stations at the correct height for ease of handling? ☐
13. Can work be slid instead of lifted? ☐
14. Are chutes, slides, used to move work from one station to the next? ☐
15. Are storage areas located as near as possible to point of use? ☐
16. Are temporary storages viewed with proper suspicion? Can they be eliminated? ☐
17. Do workers have to waste time standing at the toolroom window? ☐
18. Are workplaces arranged in accordance with work simplification principles? ☐

19. Have jigs and fixtures been provided so that both hands may be engaged in productive effort? ☐

20. Are bins arranged within the normal work area? ☐

21. Can tools be pre-positioned? Is drop delivery possible? ☐

22. Have operations been analzyed by the chart method to determine the " one best way "? ☐

23. Is work properly scheduled? Is paperwork kept to the bare minimum? ☐

24. Are machines located so that one operator can tend two or more without unnecessary steps? ☐

25. Are machine load charts used? ☐

26. Can operations and transportations be reduced by group inspections in one place covering several operations? ☐

27. Will flexible electrical distribution facilitate equipment rearrangements for short orders or special jobs? ☐

28. Can machines be equipped with self-contained driving motors and lighting units to permit easy and rapid rearrangement when operations are changed? ☐

29. How much production time (man-hours plus machine-hours) is lost per month because of breakdown? ☐

30. Are machines and equipment inspected and lubricated at regular intervals? ☐

31. Are spare motors available in case of breakdown? ☐

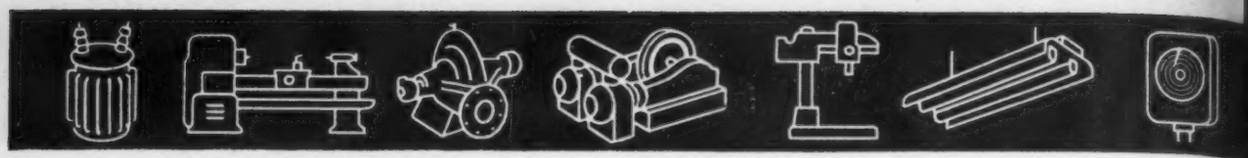
32. Are records kept to show time lost by workers getting into operation in the morning and after recess? ☐

33. Do workers have to walk unnecessarily long distances to toilets and restrooms? Can these facilities be centrally located? ☐

34. Are first aid stations located conveniently to working areas? ☐

35. Can order forms, material requisitions, inspection slips be simplified or reduced in number — with a view to saving workers' time? ☐

36. Is full advantage being taken of portable power tools? ☐

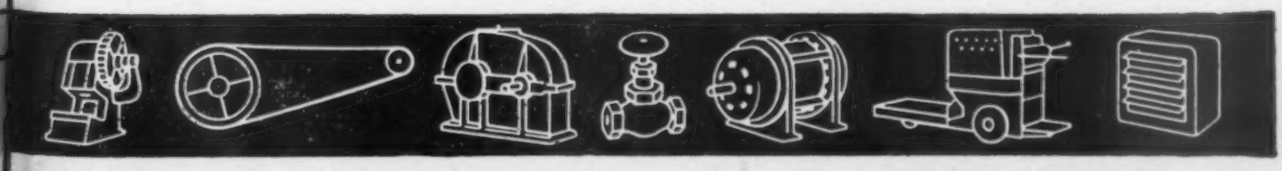


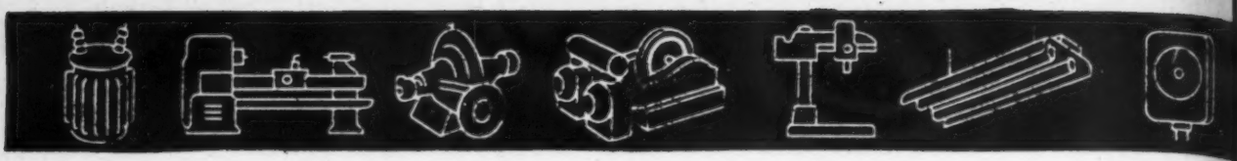
Reduce Overhead Expense

1. Is each operating department and each product charged with its actual proportion of costs? Are allocated percentages periodically checked?
2. Can standard costs be determined for repetitive items, to simplify arriving at true operating costs?
3. Has the method of charging off depreciation been checked to see if larger write-offs are legitimate?
4. Has a job analysis been made for each man with supervisory responsibilities?
5. Are foremen fully cost-conscious? Are workers told something about costs of materials?
6. Are time and expense of maintenance crews charged against specific jobs?
7. Can overhead caused by equipment remaining unused at certain times be overcome by means of a new product?
8. Has a check been made of the economics of power supply for the plant?
9. Has the utility been checked to see if the company is using the most economical power rate for its needs? Has maximum demand been checked?
10. Are wastes resulting from low power factor, low motor efficiency, poor illumination, caused by an inefficient electrical distribution system?
11. Can certain types, sizes, and styles of products be standardized in order to cut down on inventories of finished goods or parts carried in stock?
12. How much money is lost each year through spoilage of product? What percentage is caused materials? Poor workmanship? Machine performance?
13. Is the product such that losses are being incurred in the form of dust, powder, or fumes in the atmosphere? Has recovery been considered?
14. Are luxury departments — functions or services no longer profitable — being operated?
15. Can banks between operations be eliminated and in-process inventories correspondingly reduced?
16. Can the manufacturing cycle be shortened?
17. Has the number of non-productive workers in each department been checked recently with a view to elimination or transfer to other jobs?

Improve Performance of Productive Equipment

1. What percentage of factory rejects is caused by failure of equipment? ☐
2. Has every operation been examined to see whether it can be simplified? ☐
3. Will equipment performance be bettered and cost of operation decreased by changing from group drives to individual motors — or *vice versa*? ☐
4. Has thought been given to the possibility of cutting down time by having certain equipment move to the work instead of work to the equipment? ☐
5. Can some machines be regrouped so that one man can operate two or more? ☐
6. Have studies been made to determine how many machines one man can operate economically? ☐
7. Is an inadequate wiring system causing low voltage at driving motors and preventing efficient operation? ☐
8. Can the output per machine be improved by increasing machine speeds with new drives? ☐
9. Are high-speed cutting tools being utilized to full advantage? ☐
10. Will performance be improved by providing machines with a wider range of speed control? ☐
11. Do control and safety devices make all equipment in the plant foolproof? ☐
12. Are there definite lubrication schedules and records for each machine? ☐
13. Where can electric recording of indicating meters, perhaps coupled with completely automatic control, be installed to eliminate the human equation? ☐
14. Are counting and sorting done automatically? ☐
15. Have electronic devices been investigated for high-speed counting? ☐
16. Can accuracy of cyclical operations be increased by the use of electric time switches? ☐





Study Auxiliary Equipment and Buildings

BOILER PLANT

1. Are the boiler and furnaces of modern design, and in good condition?
2. Do the boilers have adequate capacity for any likely increase in load?
3. If the boilers are hand-fired, have the firemen been properly instructed in their duties? Do they follow their instructions carefully and consistently?
4. If stokers or oil burners are used, are they in good condition and properly adjusted? Are the controls suitable, and in good condition?
5. Have any studies been made to determine whether a different kind or grade of fuel would reduce steam costs?
6. Are the boilers equipped with suitable combustion controls, to insure maximum efficiency?
7. Are careful records kept of fuel consumption and steam production?
8. Has every effort been made to re-use steam and hot water? Is as much condensate as possible returned to the boiler?
9. Are adequate measures taken to prevent waste of steam and hot water?
10. Have the advantages of metering the steam used by all large departments been carefully considered?

ELECTRICAL DISTRIBUTION SYSTEMS

1. Are the power transformers in good condition in every respect?
2. Do the transformers have adequate capacity for any anticipated or likely increase in load?
3. Are all circuit breakers in good condition?
4. Do all breakers have adequate capacity to interrupt the full current to which they might be subjected when faults develop?
5. Are all fuses and holders in good condition, and free from corrosion or oxidation?

6. Do switches show signs of overheating or oxidation? Are all parts in good condition? ☐

7. Are all switchboards and panels in good electrical and mechanical condition? ☐

8. Have hazards been minimized by proper grounding and the use of suitable grilles or enclosures? ☐

9. Should switchboards and panels be moved to a cleaner location, or otherwise protected against dirt and corrosive fumes? ☐

10. Are all instruments and meters in good condition and registering correctly? ☐

11. Do the instruments and meters now used give all the data needed for efficient control and operation? ☐

12. If capacitors are used for power factor correction, are they properly protected and in good condition? ☐

13. If capacitors are not used now, has there been any investigation of the advantages they offer? ☐

14. Are all wires and cables forming the power and lighting systems in good condition? ☐

15. Is all wiring properly installed and adequately protected against mechanical injury? ☐

16. Are all circuits adequately protected by suitable circuit breakers or fuses? ☐

17. Are there adequate means for maintaining power service to equipment whose operation must not be interrupted? ☐

18. Do the power and lighting distribution systems have adequate capacity for any contemplated or likely increases in load? ☐

19. Are these systems designed for maximum flexibility of operation under both normal and emergency conditions? ☐

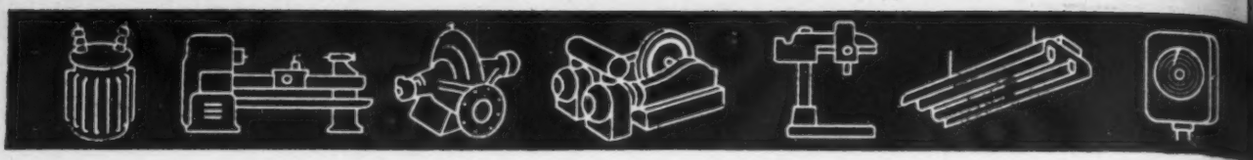
20. Do they permit changes in machine location to be made easily and with the minimum amount of rewiring? ☐

21. Have the advantages and possibilities of using a higher distribution voltage been thoroughly canvassed? ☐

MOTORS

1. Are all motors in condition to render dependable, trouble-free service? ☐

2. Have tests been made to determine whether each motor is properly loaded? ☐



3. Is the type of motor in each application properly suited to the requirements?

4. Where the service conditions are severe, would the replacement of open-type motors by the enclosed type be advisable?

MOTOR STARTERS AND CONTROLLERS

1. Are all starters and controllers in good electrical and mechanical condition?

2. Is each one properly suited to its application?

3. Do all starters have all the protective features required for maximum safety to personnel and equipment?

4. Would the use of motor and control units that give wider speed ranges and closer regulation increase the quantity and quality of production?

5. Should motor control equipment be moved to a cleaner location, or otherwise be given better protection against dirt and fumes?

LIGHTING SYSTEMS

1. Are all elements — lamps, reflectors, switches, wiring — in safe, dependable condition?

2. Are reflectors of modern design and properly suited to the service? Do they shield the light source so as to minimize glare?

3. Is the intensity of illumination adequate at all workplaces, considering the severity of the seeing task and the age of the worker?

4. Has the lighting system been laid out so that machines and workplaces can be shifted around without necessitating extensive rearrangement of fixtures?

5. Has the matter of providing inspection benches with special fixtures, or with the color or kind of light best suited to the task, been carefully considered?

6. Are the circuit arrangements and switching facilities designed to give a high degree of flexibility in the operation of the lighting system?

7. Have provisions been made for prompt replacement of burned-out or defective lamps, and cleaning of lamps and reflectors at sufficiently frequent intervals?

8. Are interior surfaces kept well painted with suitable light-reflective materials, in order to make maximum use of the output of the lighting system?

SIGNALING AND COMMUNICATION

1. Are there adequate facilities for prompt, efficient communication among key personnel and departments? ☐

2. Have paging, fire alarm, and other signals that help operating efficiency or give warning of abnormal or dangerous conditions, been installed? ☐

MECHANICAL POWER TRANSMISSION

1. Do any elements of such equipment — belts, chain drives, speed reducers, clutches, mechanical variable-speed devices — need repairs or replacement? ☐

2. Are the methods of driving production machines and other equipment best suited in each case to the service? ☐

3. Have all drives between motors and machines been properly selected as to suitabliity for the service conditions to which they may be subjected? ☐

4. Are there any machines or equipment on which a change to another kind of drive would be advantageous? ☐

Are gears, chains, belts, and other elements adequately guarded, to minimize accident hazards? ☐

MATERIALS HANDLING EQUIPMENT

1. Are all items of materials handling equipment in condition to serve dependably, and at once? ☐

2. Will the existing equipment be suitable for present and contemplated future uses? ☐

3. Have adequate safeguards been provided where stoppage or misfunctioning could endanger personnel, other equipment, or products? ☐

4. Do speed controls give a sufficiently wide range and close enough regulation of speed to insure operation at maximum efficiency? ☐

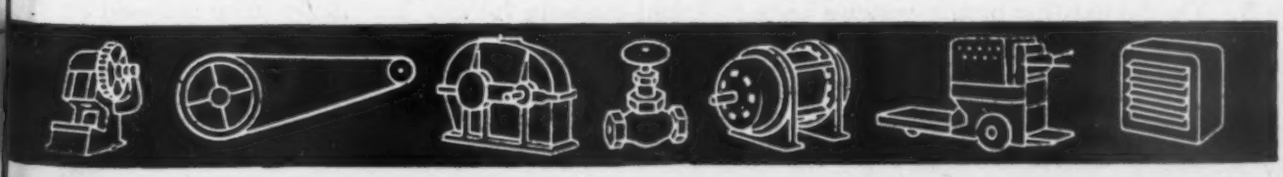
5. Are the electrical and mechanical drive elements of all materials handling equipment adequately protected against overloads? ☐

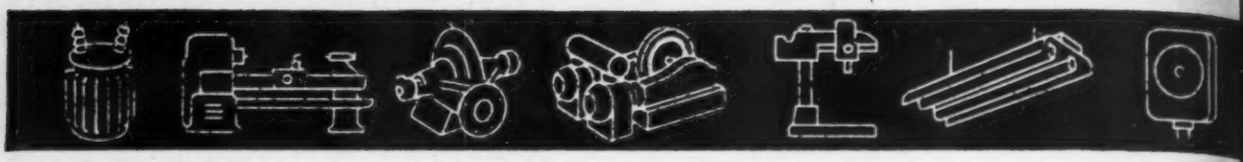
6. Will the existing equipment be adequate to handle any tonnage or volume of raw materials, parts, or products that is likely to be put on it? ☐

HEATING, VENTILATING, AND EXHAUST SYSTEMS

1. Are all elements of the heating system in good condition? ☐

2. Is it adequate to provide comfortable working temperatures in the coldest weather? ☐





3. Is the heat uniformly distributed throughout the working areas?

4. Have temperature controls been provided that will maintain the desired temperatures within close limits?

5. Would replacement of the existing heating units with others of a later design or different type reduce steam consumption or give other worth-while advantages?

6. Has the heating system been designed for flexibility in operation, so that portions that are not needed may be readily cut out?

7. Do partitions or other obstructions deflect or interfere with the flow of heated air from unit heaters or other heating equipment?

8. Has the advisability been considered of installing electrically heated or direct fired unit heaters in remote areas, to avoid the need for long steam lines?

9. Is all ventilating equipment in good condition?

10. Is the existing equipment adequate for the duty imposed on it?

11. Would the installation of additional ventilating equipment, or equipment of different design, improve working conditions?

12. Are all parts of the exhaust systems in condition for efficient operation?

13. Is the existing equipment suitable and adequate for the service?

14. Could working conditions be improved, or hazards reduced, by the installation of additional exhaust equipment, or equipment of different design?

PIPING SYSTEMS

1. Is all piping — steam, water, compressed air, gas — relatively free from scale or corrosion and in good condition?

2. Is all piping properly pitched and supported?

3. Are steam and hot water pipes adequately insulated? Is the insulation in good condition throughout?

4. Are all valves in good condition? Do any valves need repacking, repairs, replacement?

5. Do the existing piping systems have sufficient capacity for any load likely to be imposed on them?

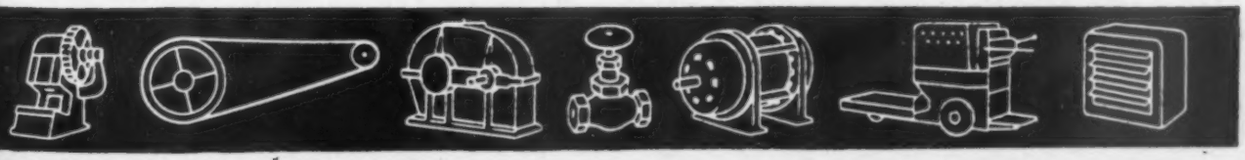
6. Are the piping systems simple in layout and easy to trace in the event of trouble?

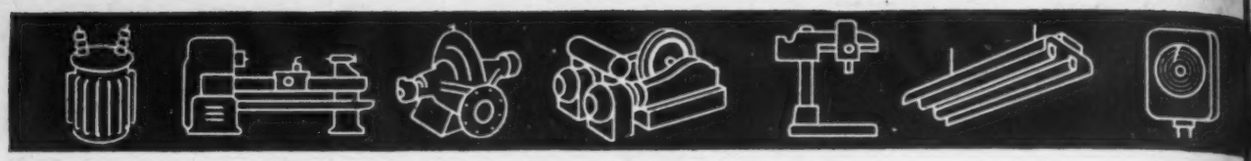
FIRE PROTECTION

1. Are all areas properly protected by a sprinkler system? ☐
2. Are all areas adequately provided with hose lines and fire extinguishers suitable for the hazards? ☐
3. Have all fire or explosive hazards been studied and suitable safeguards installed? ☐
4. Is there an adequate fire alarm system? Are there adequate provisions for calling the city fire department? ☐
5. Has a plant fire department been organized, and the members been properly instructed in firefighting methods? ☐

BUILDINGS

1. Do roofs leak, or require repairs to put them in good condition? ☐
2. Are floors in good condition? Are repairs needed to minimize tripping or slipping hazards, and facilitate the movement of trucks? ☐
3. Do exterior surfaces of walls need pointing, painting, or waterproofing? ☐
4. Is calking needed around doors, windows, or other openings? ☐
5. Does the sash need reglazing, repairing, or replacement? ☐
6. Has the advisability of insulating roofs, to reduce temperatures in working areas in the summer and reduce heat losses in winter, been considered? ☐
7. Do interior wall and other surfaces need painting? ☐

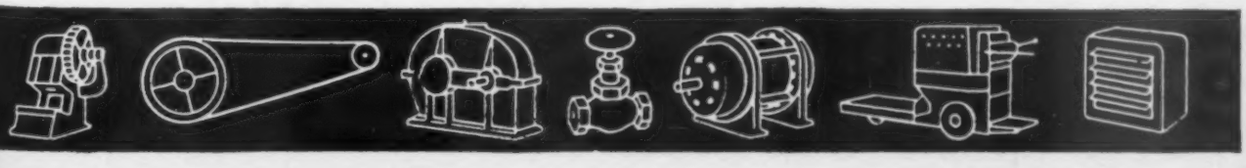


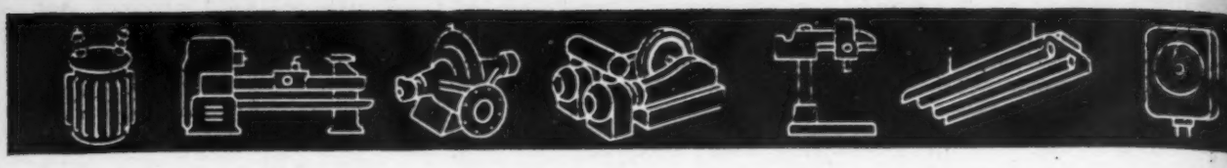


Survey Working Conditions

1. How does rate of labor turnover compare with that of representative plants in the industry?
2. Are absenteeism records kept and analyzed with a view to determining causes and correcting them?
3. Are scientific recruiting and selection methods used?
4. Is the new worker properly inducted, introduced to his foremen and fellow-workers? Does he receive full instructions on his job?
5. How does the scale of wages and salaries compare with other plants in the industry?
6. Are jobs classified and analyzed to determine fair rates of pay and to guarantee an equitable wage structure?
7. Has a merit rating plan been installed?
8. Has the possibility of some form of incentive payment been checked?
9. Does the company use modern methods of upgrading employees? Are promotions made from within?
10. What methods are used to transmit company plans and policies to the lower echelons of supervision — and to workers?
11. Are grievances handled carefully. Are they analyzed with a view to eliminating the source?
12. Is discipline maintained in accordance with a carefully thought out plan?
13. Does the company employ counselors for employees?
14. Are exit interviews used to determine causes for quits — with a view to elimination?
15. When employees are laid off, are they told why?
16. To whom does the director of personnel relations report?
17. Have repetitive operations been studied, process charts drawn up, to show employees the most efficient, hence the easiest, way to do each job?
18. Has a definite person in each department or on each floor been made responsible for plant housekeeping? Has a good housekeeping contest been tried?

20.	Are employees given enough light to work efficiently? Have operations been checked to determine actual foot-candles of illumination provided?	☐
21.	If illumination is of sufficient intensity, is it free from glare or confusing shadows? Does it permit accurate color discrimination where necessary?	☐
22.	Has a trial installation of new lighting been made to find out whether improvements in inspection or assembly might result?	☐
23.	Does the general overhead illumination permit machines to be arranged, and workers to stand, in any position, without interfering with illumination?	☐
24.	Is the illumination at the working plane aided by properly painted walls and ceilings?	☐
25.	Have the possible benefits of using colors on walls, machines, and equipment been investigated?	☐
26.	Is the lighting absolutely independent of daylight? Are machines near windows getting improper light — glare, shadows?	☐
27.	Where light is flickering or poor, is the fault insufficient voltage at the sockets?	☐
28.	Is maintenance of illumination systematic? Are cleaning schedules carefully adhered to?	☐
29.	How does the company's record of man-hours lost through sickness or accident compare with that of representative plants in the industry?	☐
30.	Do mistakes and accident records show more occurring late in the day? Dot hey indicate a worker-fatigue condition that needs correcting?	☐
31.	Have employees been instructed in safety procedures? Are special safety meetings held? Are workers trained in first aid?	☐
32.	Is the plant publication used to disseminate safety information? Is full use being made of available safety signs, posters, literature?	☐
33.	Has all machinery been equipped with safety devices?	☐
34.	Are goggles provided? Safety clothing? Safety shoes? Is their use compulsory?	☐
35.	Are posture chairs provided for bench workers? Are benches the correct height for convenience in working?	☐
36.	Have equipment controls and bins for material been arranged to eliminate all unnecessary walking, reaching, lifting, straining?	☐
37.	Are women employees permitted enough rest periods during the day?	☐
	Are attractive restrooms provided where women can congregate during lunch hour and recesses?	☐





38. Are lockers provided for all employees? Are locker rooms kept clean and well ventilated? ☐

39. Is the heating in the plant spotty? Are there drafts? ☐

40. Has air conditioning for health been considered? ☐

41. Are workers protected by dust and fume elimination equipment where necessary? ☐

42. Is the plant a fire hazard? Are fire protection devices installed? Is there a fire department? ☐

43. Do avoidable noises in the plant actually sap employee energy? Have studies been made with a view to reducing or eliminating such noises? ☐

44. Has the company accepted the responsibility for providing good meals? ☐

45. Is the plant cafeteria conveniently located so that workers can patronize it within the time allowed? ☐

46. Has any arrangement been made so that workers may have a between-meals snack? ☐

47. Does the company employ a dietitian? Is any effort made to educate workers and workers' families in nutrition? ☐

48. Are recreational facilities provided? Do employees run their own recreation association? Does the company provide a recreation director? ☐

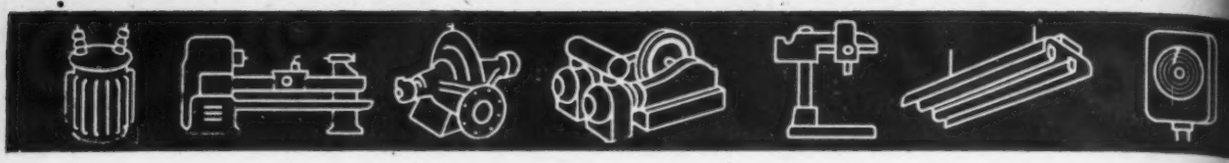
49. Are social and educational as well as athletic activities encouraged? ☐

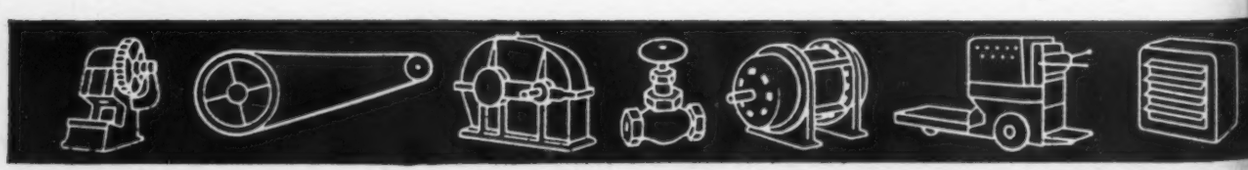
50. Does the company provide ample parking space for employees? ☐

51. Is proper attention given to plant exterior, planting, and grounds — with a view to making the plant "look like a good place to work"? ☐

Set Up Preventive Maintenance

1. Is the plant maintenance function centered under a definite head with complete maintenance responsibility? ☐
2. Is there centralized grouping of all maintenance departments to reduce supervision and clerical delays, and to insure prompt handling of all work? ☐
3. Are maintenance expenditures provided for by a budget? ☐
4. Is all maintenance work — no matter how minor — covered by an order number, and are the costs properly allocated? ☐
5. Do the records show where every dollar spent on maintenance has gone? ☐
6. Do the maintenance order forms show clearly the amounts spent on *repairs*, *replacements*, and *new work*? ☐
7. Can such figures readily be broken down according to the *class* of equipment involved, as a guide for budgeting future maintenance expenditures? ☐
8. Has the possibility of putting some kinds of maintenance work on an incentive basis been studied? ☐
9. Have the routine maintenance practices been reduced to written standard instructions and methods? ☐
10. Have adequate provisions been made for the training and supervision of new maintenance personnel? ☐
11. Is the maintenance department given a proper voice in the *selection* as well as in the upkeep and repair of equipment? ☐
12. Are possible service interruptions anticipated by definitely scheduled inspections of all equipment and buildings? ☐
13. Have the lubrication requirements of all equipment been carefully studied and suitable specifications and schedules prepared? ☐
14. Are the oilers carefully selected, trained, and supervised? ☐
15. Are adequate stocks of renewal parts for all equipment kept on hand — or is a local source of supply guaranteed? ☐
16. Is the maintenance department provided with all the tools and equipment needed to perform its work properly and efficiently? ☐
17. Does the maintenance department have an adequate staff of capable, experienced men? ☐
18. Has consideration been given to the advisability of having outside contractors handle maintenance jobs that require specialized equipment and men? ☐



Prepare for Expansion

1. With the cost data and methods available now, how accurate an estimate can be made of probable unit costs under definite volume increases?
2. Are market data available to show whether or not greater quantities of the product, made by present methods, could be sold at profit-producing prices?
3. Would a slight design or material change in the present product make it possible to attract hitherto unattempted markets with a differently priced line?
4. Are there bottlenecks in the operations, and has it been determined how to open them when more business comes in?
5. Would revised plant layout or modernized drives free valuable factory space?
6. Are key machines capable of sudden increases in volume?
7. Is advantage being taken of the automatic processes that have become general in the industry? Are all such technological advances being closely followed?
8. Is there a dependable source of basic materials and supplies?
9. Is the present power source capable of supplying increased demands efficiently?
10. Would the present storage methods be able to take care of a sudden volume increase?
11. Are proper employee training methods insuring a supply of special skills?
12. Has the establishment of an apprentice system, or the taking advantage of "cooperative" engineering and trade schools, been considered?
13. Are there concerns which can be depended on to subcontract parts that are now being made by the company, in the event of an unexpected increase in business?
14. Is the company's reputation as a dependable source of supply being jealously guarded, in order to invite offers of new business?
15. Have financial requirements for materials, parts, and equipment for expansion been calculated, and has a plan been made to cover them?